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ABSTRACT

Thirty-nine papers from the conference "Discovery '84: Technology for Disabled Persons" are presented. The conference was intended to provide an overview of the areas in which technological advances have been made, including the applications of computers and other related products and services. Conference presenters represented fields of education, counseling, special education, vocational rehabilitation, and computer science. The papers in the current volume address topics dealing with various ways in which computer technology can enhance the lives of the handicapped and disabled, biomedicine (including a paper on biomedical techniques for post head trauma victims), environmental control (including issues such as the management of incontinence), transportation issues such as a functional urban paratransit system, and communication issues such as a communication system for nonvocal physically impaired persons. (CL)

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Discovery '84:

TECHNOLOGY FOR DISABLED PERSONS

CONFERENCE PAPERS

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TECHNOLOGY FOR DISABLED PERSONS

CONFERENCE PAPERS

Edited by
Christopher Smith
University of Wisconsin-Stout

DISCOVERY '84

October 1 - 3, 1984
Chicago, Illinois

Sponsored by
University of Wisconsin-Stout:
Office of Continuing Education
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Materials Development Center
Stout Vocational Rehabilitation Institute
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Menomonie, Wisconsin 54751

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Editor's Notes

Technology is enhancing the lives of millions of people with disabilities. A nationwide survey conducted fifteen years ago revealed that 6.2 million people used a total of 7.2 million assistive devices. Today more than 7,000 different assistive devices are available; the number grows daily.

Technology does not have answers to all limitations caused by disabling conditions, but the rapid pace of investigation by and for persons with disabilities will certainly continue to add devices that increase the work potentials of many to the marketplace. Douglas Fenderson of the National Institute of Handicapped Research, wrote in the August, 1984 issue of the Journal of Rehabilitation Administration that he saw more research emphasis being placed on the problems associated with disability limitations. He saw continuing research in functional electrical stimulation of impaired muscles, robotics, sensory replacement by nerve interface, biologically compatible prosthetic, orthotic and mobility devices, and implantable infusion pumps; in essence, Dr. Fenderson forsees a continued technological explosion in the rehabilitation field. Thus, professionals in vocational rehabilitation, special education, and vocational education, as well as persons with disabilities and their advocates need to keep abreast of these developments to enhance their lives and the lives of their constituents.

Discovery '84: Technology for Disabled Persons was designed to provide an overview of the many areas in which technological advances have been made, including the applications of computers and other related products and services. The participants and presenters of Discovery '84 arrived in Chicago, Illinois from 39 states. These teachers, counselors, special educators, vocational rehabilitation specialists, therapists, computer experts, and interested others came to learn about advances made in computer technology and the many innovations in technology presently impacting the rehabilitation field. And learn they did; 84 presenters conducted over 100 sessions, reporting research results, discussing software modifications, showing computer and computer-related equipment designs, and demonstrating technologically innovative products and services. In addition, 38 exhibitors packed the exhibition hall with the latest devices.

From all these educational presentations, the 39 papers herein bound were gathered. The papers cover the rehabilitation-relevant technological aspects of computers, biomedicine, environmental control, transportation, and communication. This book of conference papers will expand the impact of Discovery '84 beyond October 1-3, 1984, and will hopefully lead innovators to the imaginative spark that preceeds the development of new ideas.

This book is the culmination of well over a year's worth of effort on the part of many staff members at the University of Wisconsin-Stout. Discovery '84 was jointly sponsored by two units. The Office of Continuing Education and Summer Session, part of Stout's Division of Academic Affairs, coordinated the conference site preparation, advertisements, and presentations, lead by Director of Continuing Education and Summer Session, John Van Osdale and Conference Coordinator, Janet Roehl. The Stout Vocational Rehabilitation Institute, within the School of Education and Human Services, screened presentations, provided on-site coordination, and published this book, with leadership from Executive Director, Paul Hoffman. No undertaking of this magnitude is ever achieved without the cooperation of many minds and hands. Thanks are due to the staffs of both units for pulling together to provide the ultimate benefits to you, our most valued constitutents.

The herculean task of turning papers of various styles, along with sometimes illegible copy editing notations, into a camera ready form was ably executed by Mary Bates. Mary and our word processing troubleshooter, Darlene Shane, completed the processing and proofing with skill and good humor. I thank you both.

The ideas, products, services, and opinions expressed in these papers reflect the thinking of their authors. Their inclusion in this publication does not necessarily constitute endorsement by the office of Continuing Education and Summer Session, Stout Vocational Rehabilitation Institute, or the Materials development Center of the University of Wisconsin-Stout.

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February, 1985

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BRINGING COMPUTERS TO THE HANDICAPPED

JAMES B. ABBEY

ABSTRACT

Over the last two years J.A. Preston/ComputAbility and United Cerebral Palsy of New York City have had many discussions regarding bringing computers to the handicapped. As an extension of "The Handicapped Source" and its products, ComputAbility contracted with United Cerebral Palsy of New York City to act as consultants in a "Needs Assessment Study." This study focused on the clientele of UCP of New York City and how computers can be used throughout the agency and by as many clients as effective.

A period of twenty days over several months was spent by our team in interviews, organization analysis, class and client/staff monitoring, project definition and feedback analysis on projects. This effort resulted in a comprehensive written report targeting specific areas where integration of computer use for UCP's clientele will be most applicable.

With the advent of low cost microcomputers, the opportunity to provide new technological aids for the handicapped has broadened. ComputAbility, through its division, "The Handicapped Source," offers a variety of software and hardware products geared to the handicapped. These products assist the handicapped in many ways including, vocational, educational, communications, environmental control, and entertainment. In addition, the handicapped have the same "rights" as anyone to have access to this technology.

A Needs Assessment

"The relevant question today is not whether computers will be used to help solve instructional and communication problems of the handicapped, but rather how they will be used and how they will effect the education of the handicapped in the next decade" (Watson, p. 670).

"For a physically disabled child who has limited access to the world of motion and spatial relationships, for a learning-disabled child who shows a flair for geometric problem solving, and for a nonverbal child who is blocked in establishing communication, developing a facility in using a computer can be regarded as an essential educational experience" (Weir, p. 342).

Goal: Bringing Computers to the Handicapped

Bringing computers to the handicapped is a process that involves many steps to be successful. Bringing computers to the handicapped does not mean just allowing the handicapped the use of computers in school or for special purposes. The goal of this project has been defined as allowing all individuals access to computers and providing a computer to each and every handicapped person who can use one. In order to accomplish this goal, U.C.P. must reach two objectives: 1) Implement computers throughout the agency to allow access to computers by all its clients; and 2) get the appropriate legislation passed that will help provide computers for any handicapped individual needing one. Once these two objectives have been achieved, the process of Bringing Computers to the Handicapped will become only a process of time and effort to supply the computers.

United Cerebral Palsy of New York City (UCP) has realized the impact that the computer industry is making on society. To capture this technology and put its benefits to use by and for the handicapped, a Needs Assessment was conducted among the UCP programs. To investigate those areas most appropriate for integration of computers and to evaluate the needs of the clients, UCP teamed with J.A. Preston Corporation and its subsidiary ComputAbility Corporation.

By its association with J.A. Preston and ComputAbility, UCP has made a strong connection with the computer industry and a commercial provider of products for the field of rehabilitation. This association is one of three priority actions seemed necessary by J. C. DeWitt of the American Foundation for the Blind in New York, New York, for a computer program to become truly successful. At the Discovery '83 Conference on Computers for the Disabled, sponsored by the University of Wisconsin-Stout and Closing the GAP, Mr. DeWitt drew the following conclusions in his presentation:

> "First, I suggest that potential and actual users meet and work together to form a consensus of what approaches need to be taken. Second, developers and manufacturers should work more closely together in order to increase general accessibility, compatibility and reduce redundant efforts. Third, I would like to see major companies in computer technology brought into closer working relationships with developers and users, by helping companies identify common product development and marketing approaches. By joining forces with leaders in the industry, impaired individuals have a better chance of obtaining accessible products at a cost they can afford" (DeWitt, 1983).

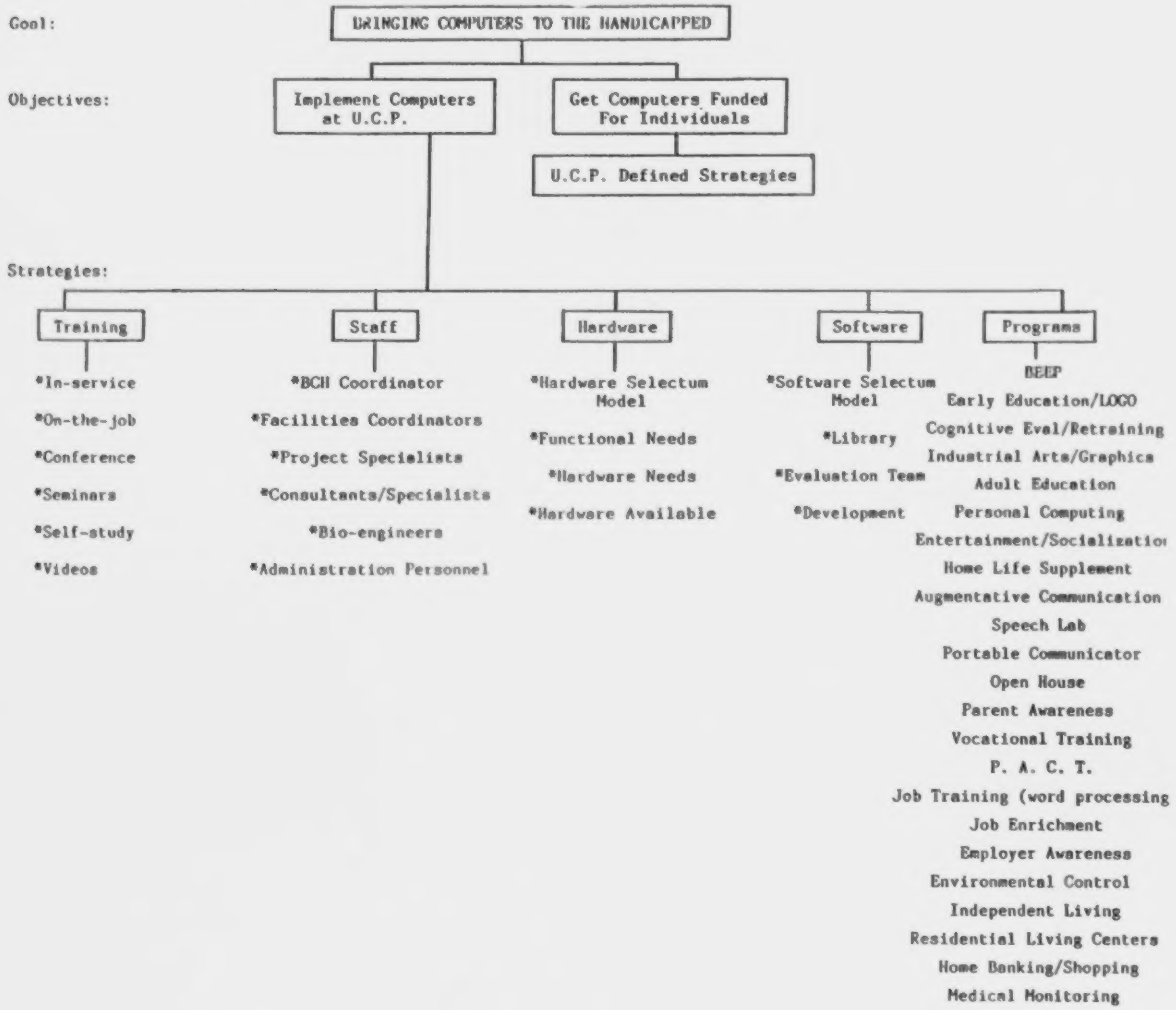
The objectives of the Needs Assessment Study are:

1. Present the current influence and growth of computer usage in educational and rehabilitation settings.
2. Define the needs and methods by which UCP of New York City can bring computers to the handicapped.
3. Outline how to integrate and coordinate key activities to achieve optimum operational efficiency and effectiveness.
4. Identify those individuals at UCP who will participate in the implementation of the program.
5. Define and outline costs involved and the timeframe to implement the programs.

Recommendations:

The Needs Assessment investigation and our research have led us to conclude that:

* There is no reason not to give access to computers to all, including the handicapped. We have seen from the current state of the art and the implementation of computer technology throughout the world that the computer


Goal:
BRINGING COMPUTERS TO THE HANDICAPPED
Objectives:
Implement Computers at U.C.P.
Get Computers Funded For Individuals
U.C.P. Defined Strategies
Strategies:
Training
*In-service
*On-the-job
*Conference
*Seminars
*Self-study
*Videos
Staff
*BCH Coordinator
*Facilities Coordinators
*Project Specialists
*Consultants/Specialists
*Bio-engineers
*Administration Personnel
Hardware
*Hardware Selectum Model
*Functional Needs
*Hardware Needs
*Hardware Available
Software
*Software Selectum Model
*Library
*Evaluation Team
*Development
Programs
BEEP
Early Education/LOGO
Cognitive Eval/Retraining
Industrial Arts/Graphics
Adult Education
Personal Computing
Entertainment/Socializatio
Home Life Supplement
Augmentative Communication
Speech Lab
Portable Communicator
Open House
Parent Awareness
Vocational Training
P. A. C. T.
Job Training (word processing
Job Enrichment
Employer Awareness
Environmental Control
Independent Living
Residential Living Centers
Home Banking/Shopping
Medical Monitoring

has the potential to greatly impact the handicapped.

* There are a number of unique opportunities for the handicapped and their use of computers. It is probably the most important device to free the handicapped from many of the restrictions placed on them.

* Many of the current projects under way at UCP relating to computers have developed models for successful implementation of computers throughout the agency. With the proper steps the expansion to all clients can be successful as well.

* The time is appropriate for an agency such as UCP to begin the process of bringing computers to the handicapped. The following section outlines our recommendations and the details of the various steps and models to implement in this process.

To best present the steps to take to Bringing Computers to the Handicapped the diagram above outlines our recommendations:

A Summary of Conclusions

The Needs Assessment Completed at UCP indicated a tremendous need for consortium of large non-profit organizations servicing the handicapped, national distributors of rehabilitation efforts to develop proper programs and products, widespread use of computers by the handicapped will not become a reality. Each member of the consortium has a very crucial role:

- * In addition to contributing the necessary inputs for product function, the servicing organizations are in the best position to work toward the advocacy of the handicapped in getting legislation passed to get computers paid for.
- * The distributors have the responsibility to build the proper marketing and service programs to support the users of the products as well as to provide the product. The distributors are in the best position to provide the adaptations, installation, training, and service to the users.
- * The manufacturers must become intimately familiar with the needs of the handicapped so that the proper interfaces and functions can be built into products. In addition, programs must be set up to offer products through the distributors specifically for the handicapped at reasonable prices.

The first steps in the creation of this consortium have been taken with UCP of NYC who are conducting this Needs Assessment with the assistance of the J.A. Preston Corporation and its subsidiary ComputAbility Corporation. The next step has been initiated with the interest expressed by I.B.M. to discuss the process of bringing computers to the handicapped. All of the parties required for successful implementation of the goal of bringing computers to the handicapped are being assembled.

* UCP of NYC is one of the largest non-profit organizations serving the handicapped.

* J. A. Preston Corporation is a major distributor of rehabilitation products throughout the world.

* ComputAbility Corporation has the expertise to provide the adaptations, installation, and service required by handicapped users.

* I.B.M. is the largest computer manufacturer in the world and has products that have become standards in the computer industry.

Interest has also been expressed by Kessler Rehabilitation Institute to participate in the consortium. Kessler offers a unique client population as well as a different form of health care from that of UCP.

With proper cooperation and planning the products and services needed for widespread use of computers by the handicapped will be ready when the models recommended in the Needs Assessment have been implemented by UCP and have shown positive results.

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MICROCOMPUTER ACTIVITIES IN A SENIOR DAY CARE CENTER

RUTH ZEMKE

ABSTRACT

The Fullerton, CA Senior Day Care Center incorporates microcomputer activities into the daily activity programs of frail elderly citizens. The computer activities are blended with familiar activities and include the use of commercially available software and hardware. Game show and board games provide the basis for some activities, while the production of art works, banners, and greeting cards produce useful objects and a source of pride. Music is enjoyed by clients. The synthesizer acts as a disc jockey for sing-alongs and dances. A few of the inexpensive commercial programs are particularly useful as adaptations for common sensory and motor limitations of group members. In general, the elders at the Senior Day Center are definitely a part of the microcomputer generation.

What comes to your mind when you think of medicine, old people, and technology? Life support systems? Pacemakers? Intensive care units? At the Fullerton Senior Day Care Center, in Fullerton, CA, they think of the Apple II+ microcomputer. While geriatrics and technology have been linked in all of the "high tech" ways first mentioned, the relatively "low tech" linking of frail elderly people and personal/home microcomputers is relatively unexplored. Microcomputers have removed some of the mystery from technology, and they have begun fitting into our daily occupational routines. So, while children are practicing multiplication tables on the school's microcomputers and their parents are adjusting to microsystems at work and possibly at home, some grandparents are fitting an Apple II+ into their round of daily activity in the Senior Day Program.

Program

The Fullerton Senior Day Care Center is a program of the YMCA. It is designed to provide a community service for a target population that includes the slightly confused or moderately disabled elder, possibly on a fixed or limited income. These clients are usually under a physician's care and cannot spend their day hours alone as they need some assistance in carrying out daily activities. The Center provides an alternative to institutional care when assistive programming and support systems are needed by the client rather than 24 hour medical care. The goals of the Senior Day Care Center are: 1. To provide frail elderly persons with a community service designed for their care and interests; 2. To foster independent living; 3. To postpone or prevent institutional placement; and 4. To give respite to families.

To meet these goals, the Center is open from 6:00 AM to 6:00 PM, Monday through Friday, in an attractive activities building at Fullerton Park, convenient to freeway access. The community's health, social, religious, and other agencies provide a high level of service to clients and their families as needed. The Center meets all standards and regulations of the State of California/Community Care Licensing. The program is funded in part through Title III, the Federal Older Americans Act. Program fees are based on the client's daily length of attendance and income, on a sliding scale.

An extensive program schedule is planned which contains both routines and variations. Some of the routines are breakfast, lunch, and nourishment schedules, remotivation reminiscence procedures, and mild to moderate exercise. Variations include birthday and holiday celebrations, picnics in the park, and the reception of visitors from the nearby preschool program.

Games

To many of the Senior Day Care Center's clients, the most recognized part of the computer system is the monitor, a color television set. This familiar object allows a very nice transition into the use of the computer for activities that are like most TV game shows. Clients have seen day-time TV shows or perhaps even remember prime time quiz shows from years back, prior to the scandal-ridden shows of the demise.

Word Games

One example of a simple activity based on this game show style is the educational game by Scholastic, Inc., called Square Pegs. Players are confronted by a board with numbered squares behind which are hidden words or phrases. The object of the game is to correctly locate identical pairs. Correct answers are rewarded by a sequence of lights, bells, whistles and graphics common to the game and arcade programs. The program is simple to understand and operate and can be set for a single player (against the computer) or for two players. One common adaptation used for games of this sort is to divide the group into two teams. A staff member, volunteer, or another client enters the responses for both teams. The need for this adaptation varies with the client group's ability to handle interactions with the computer and participate in the game. User constructed games allow the simplicity or complexity of games using paired words or phrases to be developed that are appropriate to the group.

The Game Show uses animated color graphics to present a wide variety of topics in the style of the popular game "Password." This game is played by two teams. Each team has a partner on the computer screen like the celebrity "regular" on TV game shows. These "regulars," Joe and May, help their teammates guess a mystery word by providing helpful hints or clues (Zwalokow, Rowe, & Perry, 1982). The disk contains ready-to-use mystery words and clues organized into 16 categories. Some of the following have been appropriate for our groups: 1. Animals - name the animal; 2. American History - important people and places; 3. A, B, C, D, F, G, or H Words - easy vocabulary words beginning with whichever one on the letters was chosen; 4. Advanced Vocabulary - more difficult vocabulary, providing a challenge for our more alert players; 5. Famous Cities - clues from fact and fantasy; and 6. Computer terms - a challenge for the occasional group member interested in the computer itself. Additional subject diskettes termed "Learningware," include word recognition from language, science, and social studies classwork. These programs are suggested by the developers as appropriate for ages 6 - 9 years or 9 - 11 years. People, places and things programs are those suggested for use by ages 9 years to adult. The subject movies and television for ages 11 years to adult.

The ability to create one's own categories, clues and answers is one of the most useful aspects of The Game Show. This menu-driven option allows staff to develop subject areas that reflect personalized topics, often those concerning current program themes. Subject areas may be developed gradually as the theme is presented in the program activities. A target word is entered with alternate acceptable forms, along with up to ten clues of less than 38 characters. Each item may be saved on the disk until the subject area has enough items for a game, or the theme has been completed in the activity program. This way The Game Show reinforces material from the weekly program theme, recent adult learning experiences, or other topics concerning shared program experiences. According to one client, "It's like having our very own TV show!" The programs reflect the experiences of the clients and can be developed at a level of difficulty providing "just the right challenge" for motivation and optimum participation.

Another computerized game show format under consideration for use is the Tic Tac Show, also by Computer Advanced Ideas, Inc. Once again, the word identification format is used, this time with the clues/questions encased in a game of tic-tac-toe. The master disk includes 14 topics from myths to math, with additional subject diskettes available on elementary school level language, math and social studies, history for ages 9 years to adult and sports facts for ages 11 years through adult. The authoring system again allows the user to develop items appropriate to a current topic for the group. The primary benefit of the additional program would be a format change as the novelty of the present program formats and reward sequences wears thin.

Other word games we have considered include the traditional hangman game and a Spanish language version. These games lacked sufficiently positive responses from the group to consider them an improvement over their paper and pencil versions. The database of famous sayings available within the programs was attractive, but staff did not feel that asset offset the cost. The Spanish Hangman by George Earl (1983) (Spanish to English or vice versa) was considered because some clients have English as a second language, and many Southern Californians have a familiarity with basic Spanish. The Spanish translations, however, were often not of the vernacular familiar to members of the group.

A more popular word game is the Crossword Magic program. With this software, it is possible to create a crossword puzzle that ranges in size from a three by three square to twenty spaces by twenty spaces. The puzzles, created from your choice of words and clues, are not of the tightly knit format used in newspapers. They have more blank spaces. Puzzle development is an interactive process. Individuals or groups can choose the theme, enter words and watch the puzzle develop on the screen. The visual presentation may stimulate new word ideas that bridges gaps or links earlier words. In the newer version, Crossword Magic 2.0, the computer can be commanded to try again by repositioning (R) a word if an alternate placement is possible (Stanton, Wells, Rochowansky, and Mellin, 1984). Entering clues for each word can be an entertaining project for an alert individual as the clues can be as factual or humorous as the person's own style.

It is possible to save an incomplete or completed puzzle, to complete or edit one later, to simplify clues which are too difficult for the client group and to otherwise modify the puzzle to satisfaction. The puzzle may be printed in hard copy using a dot matrix printer for use with traditional paper and pencil. Blank spaces and clues can be listed for addition later. The puzzle may also be solved on the monitor screen in the play mode. Keyboard entries provide cursor arrow movement; the space bar controls cursor changes from horizontal to vertical. Entered answers may be saved for later completion or modification, if time runs short. This program, with graded levels of participation possible, provides cognitive and social stimulation for most group members at their individual participation ability level. Stimulation is provided through puzzle development, theme vocabulary recall, word recognition or simply spelling practice.

Board Games

A variety of games of the "board"

variety are available for personal computer systems. These are among those games of interest to our clients. The ubiquitous Bingo game, for example, has its counterpart version, Computer Bingo, which produces caller numbers (B17, etc.) in the form of visual presentations on the monitor. With a speech synthesizer, the computer can actually call out the numbers. The novelty of the computer Bingo game is its primary benefit. A human Bingo caller is infinitely more adaptable and flexible and has the ability to adjust presentation style to maintain the group's attention and interest. Similarly, the versions of Checkers, Chess, and Odin (or Othello) are of interest primarily to individuals who do not have an appropriate human partner available for the game. These individuals have a greater interest than most clients in interacting with the computer system.

The Checkers (1984) game includes 16 levels of difficulty, instant replays of moves, and the ability to adjust over 50 program parameters to experiment with the way the computer works/plays the game. Few of these options are useful to our clients because of their compexity. Othello is a strategy game played on a 8 x 8 board where the object is to control the most squares. Each player must place a colored tile on a square to trap at least one of the opponent's pieces between two of their own. The pieces are two sided. When trapped they are flipped over to become the color of the successful player. The play is quite simple, but to play well is difficult. The different visual perspective produced from a two dimensional graphic representation on a monitor screen and the attention/knowledge requirements of even simple game interactions are too difficult for some group members. Although the Odesta versions of these games are deemed definitive for each game in a review by Stanton, et al (1984), they are little used by our clients.

Computer Art

Art activities have been popular with many as a leisure activity. They are increasing in attraction as computer art using graphic capabilities and a variety of input devices becomes available ("College to offer", 1982; "Computer-inspired art", 1982; Williams, 1982). Artists use computers to produce two-dimensional stills and animation; they are also applying computers to choreography, light shows, and sculpture (Peterson, 1983). Art activities have been an important part of the activity program at the Senior Day Center, and the computer is providing variations on this familiar theme. The Versawriter digitizer, the newer Koalapad digitizer, the Gibson light pen, and most recently, the AppleMouse II, have all provided new opportunities for art activities with clients.

The digitizer drawing boards are used by various group members to trace simple patterns and pictures or to design their own drawings. The Apple II+ high resolution (HIRES) capabilities (192 rows of 280 pixels-picture elements-each) produce the pictures on the color monitor (Williams, 1982). Since the center uses a color television monitor, there is more erosion of the graphic quality than a comparable computer monitor would provide. Computer monitors reproduce a greater number of the picture elements and, thus, provide a better quality reproduction of the input. Nevertheless, the group finds sufficient interest in the presentation of their own work on the screen (the "Hey, look what I did!" phenomenon is definitely not limited to childhood years) to continue to explore this medium of expression. "Paint brush" size options, combined with color choice and shading (dot mode) options, allow a lot of room for exploring even simple designs. Mirror imaging seems to be very enjoyable to our artists. A pattern in one part of the screen can be automatically reversed for a lovely symmetrical pattern across the other half or quarter of the screen. Variations can be stored and a hard copy can be produced on the dot matrix printer. We do not have a color printer available for the ultimate in hard copy. Editing and revision can produce a series of variations which can lead to extensive discussions comparing the artistic qualities and personal preferences for one version over another. The light pen with its accompanying machine language software (LPS II, 1982) provides a completely different form of input by touching the pen to the screen. It also adds commands to the Applesoft language available on the computer. While we can easily see the benefits of this method for the new user over keyboard entry, with our client group there was some anxiety to overcome before they could feel comfortable using the light pen. While a keyboard has the familiar look of a manual typewriter, the monitor is a somewhat magical electronic gadget to them. Turning dials, etc. to control the television and perhaps even dusting or wiping the screen clean is comfortable, but to actually write on the screen seems dangerous to some. So a transition from the digitizer system of making a line or mark to what we thought would be an easily accepted link between moving a pen on the screen and producing a line physically and visually contiquous to it, was not so simple. Fear of breaking the screen and producing an explosion, or misusing expensive equipment, or of danger from being so close to the rays emanating from the screen, had to be dealt with. Once again, we find that technology itself produced negative and positive reaction from different people. These psychological responses may be more important than anything else in the acceptance of technological advances for adaptations, work, or leisure.

Psychological rejection of technological advances is not limited to the uninitiated, however. Apple II owners who have had a chance to use a Lisa or a Macintosh probably enjoyed the experience; but, they don't automatically reject their familiar machines. Having invested money in hardware and software and invested time in getting to know their machines, they may reject the need for a "mouse." However, for the best of two systems, our resident computer hobbyist, Jeff Coyle, Program Assistant at the Senior Day Center, has purchased the AppleMouse II and its packaged software, Bill Budge's MousePaint (Durkee, 1984). Mousepaint is a freehand drawing program. Through the use of various tools, the movements of the "mouse" are converted into brush strokes, lines, curves, patterns and shapes,. If you want to move part of the picture you can draw an editing box around it and use the "mouse" to drag it to another part of the screen. At the top of the screen is located a list of menus, such as file, edit, aids, or font (for text). The "mouse" allows easy access and review of each menu. Thus through the potentials of digitizers, light pens, and the "mouse," our clients have a variety of options for the production of computer artworks.

Printing

Producing an object, such as hard copy of a puzzle or art work, is very satisfying ("look at what I made!"). Two pieces of software which have allowed some very pleasurable moments for the group include Banner Magic from Phoenix Software (Star, 1982), and The Print Shop.

Banner Magic produces long banners with letters up to 7 inches tall. It is great for holidays, birthdays, and other celebrations. These banners can be painted or colored after printing, thus providing several participatory levels as well as decoration for the Center. The Print Shop has been used to develop greeting cards which group members have sent to friends and relatives. With a staff member handling the program, the group or individual makes their choice of border pattern, background pattern, text front and message. At one point during this activity, the message "We grow too soon old and too late smart!" was rejected by the group, because "Computer people like us may be old, but we must be smart, too!" The group is looking ahead to the Christmas holiday for a real opportunity to use their cardmaking skills.

Music

Music has always been another favorite activity at the Senior Day Center. Sing-along is featured every week as well as occasional visits from such groups as the retired Seniors Volunteer Program (RSVP) Kitchen Band. The computer offers yet other options for this enjoyable activity. An Alpha Music Synthesizer allows staff members and volunteers to enter the tunes of many beloved, familiar songs. Although the synthesizer is not a favorite instrument of many of the elders in the group, they do like to use its organ mode to hear their favorite hymns. Song sheets have been prepared and printed by the computer whether the song leader is in good voice or not the group is ready to go. In fact, a "disco" option allows an album-like group of chosen titles to be played randomly. This option is popular for dancing.

Adaptation for Disability

Some of the available software and hardware for the computer makes it particularly adaptable for group members with sensory or physical disabilities. For example, the Echo II Speech Synthesizer (Kory & Kory, 1982) and its Echo Com program allows users to select words and sentences from the user generated menu. One man enjoys adding words to the list which "astonish" the ladies when they see the menu or hear "those words" in the synthesized speech. For visually impaired clients who wish to participate in banner making or the production of an easily readable letter with large type, the Talking Typewriter synthesizer says each letter as you type it. The Textalker option says words as they are typed. The Textalker Blind option has a letter or command menu which is searched by movement of the arrow keys. As the cursor passes the letter or command, it is spoken by the synthesizer, enabling the visually impaired client to produce written materials like other group members.

Summary

Others have noted that computing is a small, but growing pastime for older persons (Chin, 1984). In Menlo Park, CA at the Little House Senior Adults Community Center, and at Adelphi University in Garden City, New York, the elderly are involved in computer courses. While our clients at the Fullerton Senior Day Center are not in full health, they too find some learning, some fun, some work, and some social status in their computer activities. In a conversation about commercials for computers, someone suggested a motto for the Apple: "as old as Adam and Eve, as new as tomorrow!" Much of the time, we feel that would be an excellent motto for our clients as well!

Acknowledgements

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CONTROL DATA DISABILITY SERVICES DIVISION OVERVIEW

STEPHEN WASTVEDT

ABSTRACT

Control Data Corporation, a multinational company with four billion dollars in sales and fifty seven thousand employees worldwide, has been involved in developing and delivering training programs to meet the educational and vocational training needs of the disabled for over a decade. The attainment of marketable job skills for any individual is very important. For the disabled individual seeking competitive employment, obtaining these marketable skills is absolutely critical.

To meet this critical training need, Control Data has implemented computer-based clerical training programs at two well established rehabilitation agencies; Sister Kenny Institute in Minneapolis, and the International Center For The Disabled in New York. In addition to these rehabilitation agency-based training programs Control Data is also offering individual computer-based vocational training in the areas of programming, office technology and telemarketing to disabled individuals who are confined to their homes.

Because the programs offered are designed to specifically meet the needs of the competitive marketplace, the input of business has been critical. This input has been to provide entry level job requirements and has led the development of competent graduates who can obtain jobs in the competitive employment market.

Control Data has long been a world leader in the development and delivery of computer technology. When the capabilities of this technology are applied to the lives of the severely disabled, the results can be dramatic. An illustration of this can be found in the following case:

It is 7:00 a.m. on a typical weekday morning in Charlotte, Michigan. The majority of workers in this central Michigan community are preparing to commute to their places of employment. For Kirby, a 35 year old man confined to his bed because of severe arthritis, a daily commute is not possible. His arthritis has fused all the joints in his body. Through the use of computer technology, however, Kirby functions well as a designer of computer-based courseware for Control Data in Minneapolis, Minnesota. By using PLATO R, Control Data's computer-based learning system, Kirby is able to transmit and receive instantaneous communications with his work group, hundreds of miles away in Minnesota.

Kirby's situation is an example of the opportunities opened when the capabilities of computer technology are combined with the capabilities of disabled individuals. His $25,000 annual income provides clear evidence that these capabilities include a transformation from economic dependence to independence in the lives of severely disabled individuals.

Control Data has developed a series of products and services that are specifically designed to meet the vocational training and employment needs of the disabled. This activity is driven by a strategy to develop and deliver vocational training programs that provide disabled individuals with skills to successfully compete in competitive employment. By obtaining vocational skills training in areas of high employment need, disabled individuals will be able not only to integrate themselves more fully into society, but also to reach their full potential.

Historically, the traditional methods of education have been minimally effective in the delivery of vocational skills curricula to severely disabled individuals. Control Data's experience in delivering vocational training programs to this population has demonstrated that the individualized component of training delivery allowed through computer-based education, has proven extremely effective in providing disabled individuals with marketable vocational skills training.

The vocational skills training directed to the disabled is delivered by two Control Data Programs. A description of each of these programs follows:

Homework Program

For decades, American corporations have been faced with the problem of deciding what to do with employees who have become severely disabled during their employment. Not only are corporations faced with the high cost of providing disability benefits, whether direct or indirect, but they are also faced with the loss of a productive, often highly skilled employee. In the case of an employee who has become severely disabled, the company must make a choice. Does the company allow this individual to collect disability benefits and remain unproductive, or does it make an attempt to retain the employee either by making any job accommodations necessary to allow the individual to resume his job responsibilities or by retraining the individual in a new skill not limited by the disability?

The Control Data HOMEWORK Program trains individuals who have become severely disabled in the high demand skills of computer programming, telemarketing, and office technology. Skills training is provided by delivering an intense, computer-based curriculum in their homes via a PLATO computer terminal. The time needed to complete this training depends upon the curriculum selected and the speed at which the student can move through the component courses.

The student is guided through the selected curriculum by a Control Data certified instructor. Most communications between student and instructor are via the PLATO computer. This technologically advanced method of communication has proved highly efficient in the cost-effective delivery of an intensive vocational skills curriculum.

In addition to delivery of the vocational skills curriculum, the PLATO system has also proven very valuable for the delivery of a course in daily living skills. An example of this is the Independent Living Skills curriculum which has been developed by Control Data. This seventy hour curriculum is designed to provide individuals with mobility impairments information useful in their daily lives. The course will provide information that will help disabled individuals make the decisions about their capabilities for independent living.

Project With Industry Program

Control Data has operated a Project With Industry program (PWI) for the past four years. The purpose of the PWI Program is to develop relationships between Control Data, State Departments of Vocational Rehabilitation, and other rehabilitation agencies. These agencies refer disabled individuals qualified for employment to be considered in business facilities across the the country.

The Control Data PWI also has a training component. To optimize employment opportunities, disabled individuals must obtain marketable job skills. Through computer-based Learning Center at Sister Kenny Institute in Minneapolis and the International

Center for the Disabled in New York, disabled individuals are given training in high demand clerical occupations leading to competitive employment.

Approximately 140 disabled people per year are currently receiving training through these two programs. Both programs also have a very active placement component which includes the participation of large local employers. This strong link between the training and placement components of these programs has resulted in placement results that exceed the standards obtained by training programs using traditional learning methods.

To optimize the competitive employment of disabled individuals, Managers, co-workers, and personnel professionals must be given a sense of awareness toward the disabled. To accomplish this goal, a day long seminar entitled "Managing the Disabled" is offered by Control Data.

At this seminar, usually facilitated by a disabled individual, the participants receive an awareness of some issues involved with a disability. This sense of awareness involves not only the work place, but also the daily living experiences of the disabled person. Through a heightened sense of awareness, course participants increase their ability to effectively interact with the disabled. This seminar is currently being offered in Control Data facilities across the country. Plans have been made to offer this seminar to other companies in 1985.

Summary

Control Data will continue to deliver effective training programs to train disabled individuals in skills that will enhance their ability to obtain competitive employment.

We believe that the individualized instruction capabilities of an effective computer-based training program will continue to provide disabled individuals with cost effective vocational training that has proven its marketability in the competitive employment market.

With 80% of disabled individuals either unemployed or underemployed, it is critical that effective training strategies must be continued to be developed and delivered to prepare disabled individuals for competitive employment. Control data views this situation as a vital area of need, and will continue to aggressively implement training and employment strategies that will address that area of need.

FORCE CAPABILITIES OF THE PHYSICALLY HANDICAPPED AT SELECTED AUTOMOBILE DRIVING CONTROLS

DR. HAROLD F. RISK

ABSTRACT

The major purpose of this study was to investigate force capabilities of severely physically handicapped persons at selected automobile driving controls. The study was undertaken in order (1) to develop guideline criteria for the selection and prescription of hand controls and driving aids, (2) to assist in the selection of the optimal directions and configuration of force, and (3) to provide quantitative data for evaluating the driving potential of a physically handicapped person.

During the study, five different tests were administered to 54 physically handicapped subjects. They were (1) grip strength, (2) steering wheel force at the 3, 6, 9, and 12 o'clock driving positions, (3) hand control force in the forward, aft, up, and downward directions, (4) twisting strength, and (5) physical reaction time.

An analysis of the data collected in research investigation suggested: (1) Individuals varied widely in strength capabilities due to different diseases and injuries. The higher the spinal injury, and the more severe the neurological impairment the lower the strength results. (2) There was no significant difference between the 3, 6, and 9 o'clock grip positions. (3) The aft force direction of the hand control offered the best direction for braking force. (4) Twisting forward on the hand control for acceleration offered the most favorable maximal force. (5) Reaction times were slower than the .24 seconds used as a norm. Subjects who suffered a closed head injury had lower reaction times. Other disabled persons with slow reaction times were victims of upper spinal cord injuries, quad-polio, and major neurological impairments. (6) The majority of the subjects tested were unable to exert enough force to stop a vehicle under emergency driving situations (100 force pounds or more). Fifty-two of 54 subjects had means below the vehicle's required stopping value, as established by the SAE. (7) Hand dominance played no significant role in steering force, braking or grip.

Some implications of the study: (1) Further testing and research is required to clarify the relationships between more specific diseases and injuries in regard to force capabilities. (2) A study is needed that compares the effects obtained on the testing device with the actual driving success of the physically handicapped individual.

The Physically Disabled

The questions that arise in considering automotive driving by the physically disabled are practically the same as those important to able-bodied drivers. Of primary concern, the largest majority of traffic accidents can be linked, at least in part, to driver error. It is necessary, therefore, to precisely as possible understand the complex nature of the driving task in order to properly guard against such errors. The driving task involves the reception of vital information, physical action based on this interpretation, and the dynamic response of the vehicle. In order for this sequence to operate efficiently, a baseline minimum, although unknown, level of mental and physical ability is required.

The physically disabled driver has an obviously lower level of potential ability when compared with the able bodied driver. Due to the uncertainty about the levels of skill and strength required, it is not presently known the degree to which these reduced abilities will affect the driving task. Augmentation of the lower level of ability of the physically disabled through the use of assistive adaptive driving aids is possible. However, the degree of augmentation necessary and the degree achieved are like the needed level of abilities, not known. Similarly, it is not possible at this time to state whether presently available adaptive driving aids are adequate, except perhaps in the cases of those currently using them. While the physical capabilities necessary for driving an automobile with or without special equipment is not presently known, some information is available on the capabilities of various disabled groups. The abilities of those with spinal injuries are better understood than most. The functions remaining after a spinal cord injury are most clearly defined and several qualitative discussions are available. It should be noted, however, that capabilities vary with time and at least one study has shown a significant decrease in motor activity. Other forms of musculoskeletal handicaps have been evaluated with respect to establishing a recognized standard of disability, but these standards have not been directly associated with driving.

The most significant way to assess capability is to look at the remaining function and determine if it is sufficient for driving, with or without adaptive driving aids. Limited categorizations of this kind are available and have recently been extended to include a wider range of limb involvement.

Special equipment available for the physically handicapped includes such simple devices as left foot accelerators, spinner knobs, and left hand gear selectors. Right hand or push button directional signals are also available and the list extends up to full hand controls. New on the market are "less effort" or "zero effort" steering and braking systems. These systems give the more severely handicapped person a chance to drive a motor vehicle. In addition, various custom built solutions to special problems have been devised. Both regular automobiles and vans have been converted for use by disabled persons with vans preferred in severe disability cases as wheelchair entry can be more easily accomplished.

One thing that is immediately apparent in reviewing the current equipment design and development efforts for the physically disabled driver is that, apparently no safety standards exist for such devices. Also the acceptability test protocol for custom designed devices has been limited to qualitative judgments, themselves limited to deciding whether or not the person can physically exert the effort needed to drive the vehicle.

Need for the Study

Millions of physically handicapped Americans depend on their automobiles for mobility and independence. As more and more physically handicapped persons discover the economic, social and personal advantages that driving offers, the number of operators using adaptive automotive driving aids will increase.

The housing trend today is toward suburban living. Many people live in the small towns immediately surrounding large cities; their occupations, educational facilities, and shopping needs are in the city. Most people view the automobile not as a luxury but as a definite necessity; this is particularly true of the physically handicapped. Decentralization of living presents physically handicapped persons with the prospect of a life of isolation within this home if some mode of independent transportation is not made available (Rowley, 1953).

Fortunately, many devices have been created to assist the physically handicapped in boarding and operating an automobile or modified van. Special apparatus are available from driving equipment manufacturers serving the needs of the handicapped which make it possible for those with paralysis or amputations to operate an automobile (Rusk & Taylor, 1953).

There has been little research on driving with hand controls and practically no quantitative data about force input capabilities at various driving controls (steering wheel and hand controls used for braking and acceleration).

Purpose of the Study

The major purpose of this study was to investigate the force capabilities exhibited by severely physically handicapped persons on selected automobile driving controls. The study was undertaken (1) to develop guideline criteria for the selection and prescription of hand controls and driving aids, (2) to assist in the selection of the optimal direction and configuration of the force, and (3) to provide quantitative data for evaluating the driving potential of a physically handicapped person.

Methods

Five force capability tests were applied in this study. The tests were conducted at the University of Illinois Rehabilitation Education Center at the corner of Oak and Stadium Drive, Champaign, Illinois.

Subjects

The subjects were 32 physically handicapped males and 22 physically handicapped females between the ages of 19 and 47 years (average age = 26.97). Subjects were selected by telephone solicitation from handicapped students whose names and addresses were on file at the University of Illinois Rehabilitation Center and from the names and addresses of handicapped University alumni. In addition, several subjects were drawn from the local area via the Division of Vocational Rehabilitation. The purpose, procedures, and criteria of the study were thoroughly explained; at that time the prospective subjects consented to or declined from participation in the study.

The Study Materials

1. A Budd Portable Digital Strain Indicator Model p-130.
2. A Switch and balance system Model BS-6
3. A Hewlett-Packard Recorder Model 7402 A
4. Risks Driving Potential Operability Model (Patent pending)
5. Metalfilm Strain Gauges type C9-121 with a gauge factor of 2.03 ± .50% and a resistance of 120 ± .20%. Used for the hand control braking test.
6. Metalfilm Strain Gauges type EC6-121B-R2TS with a gauge factor of 2.04 ± 1%. Used for the twist and steering tests.
7. A Jaymar Grip Dynamometer
8. A miniature traffic control signal (three phase, @ 5 feet tall).

Procedure

In the course of the study, five different tests were administered to the physically handicapped subjects. They were:

Grip Strength

Using a Jaymar grip dynamometer, each physically handicapped subject was tested to determine the grip strength of both hands. For those with little or no grip (i.e., some high level quadriplegics have little or no grip) the grip test was still administered to document that fact.

Steering Wheel Force

The second test determined how

much constant and predictable force the subject could exert on the Ricks Driving Potential Operability measurement Model. Subjects were placed in front of the Model (all subjects were in manual or electric wheelchairs) with their hands resting comfortably in their laps. The steering wheel was then adjusted to clear the subjects' laps and abdomens by approximately 3 to 4 inches. If the distance was inadequate, the experimenter would adjust the Model to meet the required clearance distance. The subjects were then instructed to lock their wheelchairs into position (3 to 4 inches from abdomen) or the experimenter would secure the wheelchair in some suitable fashion (another person would hold the wheelchair) for those unable to perform the task.

Four common grip positions were tested on the steering wheel portion of the Model. They were: The three o'clock grip position, the six o'clock grip position, the nine o'clock grip position, and the twelve o'clock grip position. Each driving grip position was tested five times per hand per direction (clockwise and counter clockwise). The experimenter designated the appropriate starting hand and grip position. For those unable to grip the steering wheel with their hand, special steering devices were installed on the steering wheel to attain the proper security of the hand for testing. The steering devices included: a spinner knob, a quad driving post, a quad cuff, and a tri-post steering device.

Subjects were given instructions to exert their maximum sustained (not explosive) force on the steering wheel. As force was exerted, permanent measurements were recorded on a strip chart recorder.

The Model was calibrated periodically (after each subject) and initially checked by hanging known weights from the four different grip positions. Weights were hung in increments of 5 pounds for the purpose of calibration.

Hand Control Force

The purpose of the third test was to determine the amount of force subjects could exert on the hand control portion of the Model. Four different directions on the hand control were tested. They were: forward, aft, upward, and downward. Since the subjects were already in the Model after the steering test, no new positioning was necessary to complete the hand control test.

The subjects were instructed not to use any part of their wheelchairs or surrounding equipment as added sources of stability; this would give faulty data and information concerning their force capabilities. Also, special instruction was given on how to position the hand on the hand control. In basic arrangement, the subjects hand was to grasp the control with the palm on the hand grip and the arm and wrist as level as possible. However, upper spinal injured subjects were allowed (and a few others) to elevate their elbows slightly to better accommodate shoulder and scapula muscles; these are the muscle groups that they use or would use for driving.

In the event the subject had little or no grip (most spinal injuries), the subjects would pronate, supinate, or position the forearm one-half between pronation and supination to perform the forward and aft direction tests. Under normal driving conditions this would be an automatic position for these individuals, in the aforementioned directions. In addition, these same forearm positions were used in the upward and downward tests.

Further instructions requested that subjects exert maximum sustained force on the Model hand control in the randomly selected direction, with the predetermined hand. As force is applied, permanent records were recorded on the strip chart recorder. A total of five trials per direction per hand were given.

Twisting Strength

The twisting strength test was incorporated into the hand control system on the Model and was derived from a Wells-Engberg hand control system which would potentially use wrist extension and wrist flexion. Once again, no new positioning was necessary as the twisting test was incorporated into the hand control system.

Subjects were required to demonstrate their twisting ability by performing on the Model five times per hand per direction. The two directions of rotation for the twist were clockwise and counterclockwise.

Physical Reaction Time

A physical reaction time test was incorporated into the hand control on the Model and was an integral part of the testing procedure. Subjects were required to observe a miniature traffic light (keyed by the experimenter with the strip chart recorder) which was connected to the Model. When the red light went off, they were to apply force (both hands were tested separately) in the forward direction of the hand control as fast and as hard as possible and to hold it for at least two seconds.

Readings were permanently recorded on the strip chart recorder. From those recordings reaction time, detection time, and mean reaction time forces were collected.

Summary

In the course of the study, five different tests were administered to 54 physically handicapped subjects. They were: grip strength, steering wheel force at the 3, 6, 9 and 12 o'clock driving positions, hand control force in the forward, aft, up, and downward directions, twisting strength, and physical reaction time.

Dependent group t-tests were used to compare the minimum force poundage necessary to stop the automobile as exerted by the right and left hand. Dependent group t-tests were also used for twisting, and grip tests.

A two-way repeated measures analysis of variance was used for the steering force and hand control force tests. A priori t-tests were used to make a directional comparison of the hands in the four directions of both force tests.

Presentation and Discusion of Data

Steering Wheel Force

The mean force exerted (in pounds) on the steering wheel at each of the four separate o'clock grip positions is presented in Table 1; these means are also graphed in Figure 13. Standard deviation and 95% confidence intervals also appear in the table. Based on inspection of the raw data, it was noted that about 3% of the subjects (2 of 54) exerted force on the steering wheel which was below the two pound minimum specified as necessary by the Society of Automotive Engineers (SAE). Roughly five percent (5%) of the subjects (3 of 54) exerted a dead steering force below the 3.5 pounds required for a parking maneuver (also defined by the SAE).

Table 1

Mean Steering Force (in pounds) of Four Separate Steering Grip Positions

				95% Confidence Interval	
Source	Number	Mean	S.D.	Low	High
3 o'clock	216	58.14	53.71	50.93	65.34
6 o'clock	216	53.60	45.18	47.54	59.66
9 o'clock	216	59.69	52.44	52.66	66.72
12 o'clock	216	39.82	36.36	34.94	44.69
Total	864				

From Table 1 and Figure 1, it can be observed that the mean force exerted was approximately equal for three of the four separate grip positions, i.e., three, six, and nine o'clock (53.6 to 59.69 pounds). The mean force exerted at the 12 o'clock grip position was about 15 to 20 pounds less than that exerted at the other three positions. Discussion of the confidence interval evolves around the fact that there was such a variety of disabilities tested. At the 95% confidence interval, the range was from 34.94 to 66.72.

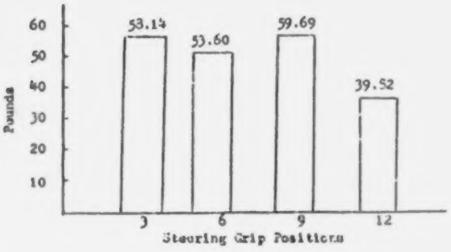

Figure 1 Mean Steering Force (in pounds) of Four Separate Steering Grip Positions

The analysis of variance (ANOVA) of the mean force exerted at the four separate o'clock grip positions appears in Table 2. A significant F ratio of 7.85 (*df* = 3,860; p ¼ 0.001) was obtained. *A priori* comparisons among means revealed that the mean force exerted at the 12 o'clock grip position was significantly less than the mean force exerted at any of the three other grip positions (Table 3, *df* = 430, p ¼ 0.001). A more detailed discussion of these findings appears in the following sections.

Table 2

Analysis of Variance Summary for Steering Wheel Grip Positions

Source	*df*	Mean Square	*F*	p < .05
Between Groups	3	17648.90	7.85	.0001
Within Groups	860	2249.49		

The mean force achieved during the steering wheel tests was found to be higher than initially expected. For a few subjects (3 percent) it was a difficult or an impossible task to obtain a steering force of 15 pounds. When total trials were explored, there were 15 subjects who had some difficulty in obtaining the necessary poundage at one of the four grip positions. Sixty percent of the subjects could not exert 50 pounds; 74.3% could not exert 75 pounds and 85% could not exert over 100 pounds in steering force. All of these figures are important to consider when determining the subjects' emergency driving capabilities. For example, a flat tire on the front of a vehicle dramatically increases the steering force requirements.

Ten subjects exhibited extreme weakness due to severe injury or disease. The weakness was most notable in quad-polio, C-4 spinal injuries, Kugelberg-Welander disease, C-5 and C-6 spinal cord injuries, and in two victims of arthrogryposis. All subjects were below the two pound automotive required value (SAE), at two or more of the driving positions, which would indicate unfavorable performance in steering any standardly equipped vehicle. This does not mean that just because those who were found operatively deficient could not drive in the future, rather there would have to be extreme modifications in the present steering wheel mechanism for the safe operation of a motorized vehicle.

The low means obtained at the twelve o'clock grip position could be attributed to the lack of grip and leverage. Additionally, the twelve o'clock grip position requires good use of elbow flexors, shoulder horizontal abductors, biceps and shoulder extensors acting together to exert the necessary turning actions.

It was found that there was a significant difference between the twelve o'clock grip position and the other three grip positions

(3, 6, and 9). Therefore, it is believed, based on the data, that the twelve o'clock grip position would be detrimental in most situations in regards to the exerting of maximum steering force. The twelve o'clock position offers limited force capabilities, poor emergency driving position and causes undue fatigue for those physically handicapped individuals who may drive from the twelve o'clock grip position.

Table 3

Differences Among Means at Each of Four Grip Positions

Grip Position	Mean	Mean Differences 3	6	9	12
3 o'clock	58.14	-	4.54	-1.55	18.32[a]
6 o'clock	53.60		-	-6.09	13.78[b]
9 o'clock	59.69			-	19.87[c]
12 o'clock	39.82				-

[a] $t = 4.15, p < 0.000$
[b] $t = 3.49, p < 0.001$
[c] $t = 4.48, p < 0.000$

The majority of the subjects tended to put their whole body weight (by leaning into the task for maximum steering at the twelve o'clock grip position. The leaning action was to compensate for the loss of vital balance muscle groups (abdomen and back muscles). Additionally, a significant tendency for loss of upper body balance was particularly prevalent at the twelve o'clock grip position. Most notable were those with high traumatic spinal injuries, some subjects with arthrogryposis, and quad-polio victims.

Directional Force of the Steering Wheel

The mean force exerted on the steering wheel in both directions (Clockwise or right and counterclockwise or left) is presented in Table 4. The standard deviations and the 95% confidence interval also appear in Table 4. The mean for the clockwise direction (58.21) was over 10 pounds greater than that of the counterclockwise direction (47.41); these means were significantly different (Table 5, $t = 3.33$, $df = 862$; p ¼ 0.001). The analysis of variance of the mean force exerted in the two directions appears in Table 6. A significant F ratio of 11.06 ($df = 1{,}862$; p ¼ 0.001) was obtained.

Table 4

Mean Steering Force by Direction of Rotation

Force Direction	Number	Mean	S.D.	Confidence Interval Low	High
Clockwise	432	58.21	51.92	53.30	63.12
Counter-Clockwise	432	47.41	43.10	43.34	51.49
Total	864				

It was found that the clockwise direction (right) produced the best or most favorable direction of rotation. The large standard deviation indicates the wide dispersion of capabilities. The mean 10 pound difference could be valuable when exploring the subjects' potentials with respect to driving emergencies and loss of power. By identifying the strongest rotation direction, subjects can be made aware of specific driving deficiency.

Table 5

Analysis of Variance Summary for Steering Force Rotation

Source	df	Mean Square	F	p < .05
Between Groups	1	25178.75	11.06	.0009
Within Groups	862	2276.48		

Hand Dominance

It was found that hand dominance played no significant role with respect to applicable force at the steering wheel. This result was surprising as the majority of the general population is stronger in the dominant hand.

It can be surmised that the handicapped subjects were generally affected equally in both limbs. Once an injury or illness has been accured, it becomes difficult for the subject to rebuild muscle strength and endurance. This is not to say the person could never drive, only that strength has been permanently lost.

Minimum Values of Steering

The mean force exerted at the four separate grip positions was compared to the minimum values specified by the SAE to determine if the measured force exceeded those minimums. *A priori* *t*-tests were conducted. It was found that all mean values exceeded the SAE suggested minimum exerted force needed to steer the vehicle.

When the mean force data were compared to the required minimum values that the automobile required, it was found that there was a significant difference between all grip positions and both minimum values (2.0 and 3.5 pounds). Several individual subjects performed below the minimum values. The most prevalent disabilities were C-4 spinal injury, quad-polio and Welander's disease. Therefore, subjects with these disabilities would require additional "booster" systems on the steering units of their vehicles to compensate for the loss of physical strength. Many companies now produce support systems for motor vehicles giving weak individuals possibilities for steering.

Braking Force

The mean braking force in pounds for each of the four independent directions is presented in Table 6; these means are also graphed in Figure 2. The means ranged from 36.01 (upward force) to 68.86 (aft force). The standard deviation and the 95% confidence interval also appear in Table 7. The large standard deviations indicate the wide dispersion in capabilities of subjects. From inspection of the raw data, it was noted that over 21% (11 of 54) failed to meet the 15 pound minimum for normal driving stopping requirements as specified by SAE. Roughly 63% (34 of 54) of the subjects tested possessed a valid drivers license, but failed to exert the SAE recommended 100 pounds necessary for an emergency stop.

Table 6

Mean Braking Force for the Four Independent Directions

Force Direction	Number	Mean	S.D.	Confidence Interval Low	Confidence Interval High
Forward	108	68.40	54.40	58.03	78.75
Aft	108	68.86	53.54	58.65	79.06
Down	108	40.28	32.92	33.99	46.56
Up	108	36.01	34.95	29.34	42.68
Total	432				

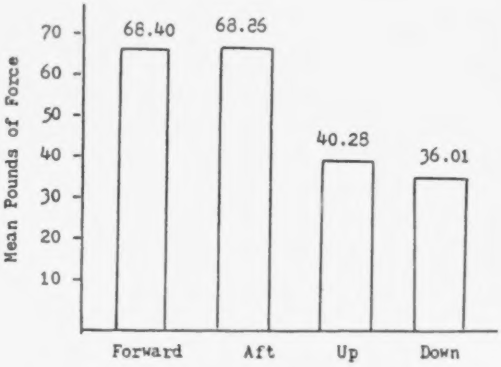

Figure 2. Mean Braking Force for the Four Independent Directions

The analysis of variance of the mean force exerted at the four independent force directions appears in Table 7. A significant *F* ratio of 16.62 (*df* = 3428; p ¼ 0.001) was obtained. *A priori* *t*-tests comparison among means revealed that the mean force exerted in the upward direction was significantly less than the mean force exerted in any of the other three force directions (forward, aft and down). Additionally, the downward force direction was significantly less than the force mean exerted at the forward and aft direction.

Table 7

Analysis of Variance for Braking Force Direction

Source	df	Mean Square	F	p < .05
Between Groups	3	33795.83	16.62	.0001
Within Groups	428	2032.93		
Total	431			

There was a significant difference between the way force was applied to the braking control. Degradation of performance was drastically noticed in the upward force direction. A majority of the subjects mentioned that the upward force direction was very awkward. They indicated that they, personally, would not want to drive a vehicle equipped with hand controls which worked in the upward force direction. This study indicated that the upward force direction only offers approximately one-half the force as the forward and aft force direction.

The majority of those subjects most notably weak on the braking test (C-4, C-5 spinal injuries, arthrogryposis imperfecta, stroke victims, and multiple sclerosis victims) performed below standard on the upward force direction. The large standard deviation indicates a large dispersion in capabilities.

The forward and aft force directions produced the most favorable results with respect to braking force. It would, therefore, seem logical for exertion of optimum braking force that the hand control mechanism work in one of the two identified directions. Currently, the majority of the hand controls on the market do work in those directions.

Forward Braking Direction

There was no significant difference between the forward mean (68.40) and the aft mean (68.86). However, it can be noted from Table 8 that there was a significant difference between the forward mean (68.40) and the upward mean (36.01) (t = 5.21; df = 108; p ¼ .001). There was also a significant difference between the forward mean (68.40) and the downward force mean (40.28) (t = 4.60; df = 108, p ¼ .001).

Table 8

Difference Among Means at Each of the Four Braking Force Directions

		Mean Difference			
Force Direction	Mean	Forward	Aft	Up	Down
Forward	68.40	-	- .46	28.12	32.39
Aft	68.86	-	-	28.48	32.85
Up	40.28	-	-	-	4.27
Down	36.01	-	-	-	-

[a] t = 4.60, p ¼ 0.001
[b] t = 4.73, p ¼ 0.001
[c] t = .92, p ¼ 0.001

This finding was not surprising and adds to the validity of the test as a measurement of braking force direction. It could be anticipated that with additional subjects the difference would also reach statistical significance. However, much more data would need to be collected for the upward and downward force direction in order to make clear assumptions.

Grip Force

No significance tests were conducted on the grip data. It has long been the contention of professional educators working with physically handicapped drivers, that grip is not necessary for driving. Table 10 contains the means for both the left and right hands.

In general, the results from the grip force test were lower than those identified in a review of literature. There was, however, no significant difference between the two grips.

Grip does not need to play a major role in the driving task. For years there have been many companies that manufacture attachments to various parts of the hand controls and other accessories of the vehicle to compensate for the loss of grip.

Table 10

Mean Grip

	Left Hand Grip	Right Hand Grip
Mean	45.33	44.09

Reaction Time

The mean reaction time (left hand = .48 seconds and the right hand = .48 seconds) at the braking control is presented in Table 11. *A priori t*-test comparisons were done; those results are also presented in Table 11.

The comparisons show that the average reaction time for the physically handicapped subjects was twice as long as it should be, as found in previous research by other authors (Gart, 1959). However, the obtained results of .48 seconds are still well below the .75 second average used for the able bodied driver.

Table 11

Mean Reaction Time

Source	Number	Mean	S.D.	*t*	*df*	*p* < .05
Right Reaction	54	.48	.229	7.77	53	.000
Minimum		.24	000			
Left Reaction	54	.48	.236	7.54	53	.000
Minimum		.24	000			

Those individuals with the most notably slow reaction times were those subjects with brain tumors, severe closed head injuries (usually from automobile accidents), and cerebral palsy.

Emergency Stopping Force

The mean force exerted with both hands (right and left) was compared to the minimum values specified by SAE to determine if the measured force exceeded those minimums for an emergency stop. *A priori t*-tests were conducted and those results are summarized in Table 12. it was found that neither hand exceeded the SAE suggested force of 100 pounds for a maximum force emergency stop. In fact, the subjects obtained means were roughly 35 pounds less. It can be noted that the right hand emergency force (59.31) was notably less than the left hand force (65.67).

One of the most important findings of this study was that the handicapped subjects were unable to exert enough force to stop a standardly equipped motor vehicle under hard emergency situations. From the study results, it could be speculated that not being able to apply ample dynamic force to the brakes is a major contributing factor to many handicapped persons being involved in serious automobile accidents.

Table 12

Mean Emergency Force

	Number	Mean	S.D.	*t*	*df*	p < .05
Right Reaction	54	59.31	47.90	-6.24	53	.0001
Minimum 100		100.00	00.00			
Left Reaction	54	65.67	53.15	-4.75	53	.0001
Minimum 100		100.00	00.00			

Driving Profile

Tables 13 and 14 display the

test results of two different physically handicapped subjects, Table 13 displays the data for C-4 spinal injury victim unable, based on strength data, to drive a conventional vehicle. The left hand of the victim produced low and unacceptable force results. The braking results are all below the minimum 15 pound braking requirements.

Table 14 displays those results of C-6 spinal injury victim with the physical strength to drive a conventional motor vehicle. All test results were above the required minimums. Although the grip data was low, it would play no significant role in his driving potential.

A two-way repeated measures analysis of variance was used for hand control force abilities. Factor A was left versus right hand, while Factor B was the motion of the hand in the four directions.

The analysis of data collected in this study were directed toward understanding and explaining the force variance among the various strength tests.

Table 13

Force Capabilities of a Physical Handicapped Person Unable to Drive Based on Strength Data

Steering Force		
Left Hand Steering Right	3 O'clock driving position	3.02
Left Hand Steering Right	6 O'clock driving position	3.49
Left Hand Steering Right	9 O'clock driving position	1.71
Left Hand Steering Right	12 O'clock driving position	3.30
Right Hand Steering Right	3 O'clock driving position	4.42
Right Hand Steering Right	6 O'clock driving position	4.65
Right Hand Steering Right	9 O'clock driving position	.53
Right Hand Steering Right	12 O'clock driving position	2.03
Left Hand Steering Left	3 O'clock driving position	0
Left Hand Steering Left	6 O'clock driving position	.68
Left Hand Steering Left	9 O'clock driving position	2.06
Left Hand Steering Left	12 O'clock driving position	1.33
Right Hand Steering Left	3 O'clock driving position	4.65
Right Hand Steering Left	6 O'clock driving position	2.62
Right Hand Steering Left	9 O'clock driving position	2.44
Right Hand Steering Left	12 O'clock driving position	3.09
Brake Force		
Left Hand Forward		7.29
Right Hand Forward		3.96
Left Hand Aft		7.09
Right Hand Aft		6.25
Left Hand Up		.42
Right Hand Up		6.51
Left Hand Down		3.65
Right Hand Down		7.08
Twisting Force		
Left Hand Forward		.78
Left Hand Back		.63
Right Hand Forward		.00
Right Hand Back		.00
Grip		
Left		.67
Right		.00
Reaction Data		
Reaction Time	Left Hand	.55
Detection Time	Left Hand	.42
$\bar{X}$ Force Reaction Time	Left Hand	7.92
Reaction Time	Right Hand	.17
Detection Time	Right Hand	.23
$\bar{X}$ Force Reaction Time	Right Hand	6.72

Table 14

Force Capabilities of a Physically Handicapped Person Able to Drive Based on Strength Data

Steering Force		
Left Hand Steering Right	3 O'clock driving position	27.91
Left Hand Steering Right	6 O'clock driving position	30.46
Left Hand Steering Right	9 O'clock driving position	46.51
Left Hand Steering Right	12 O'clock driving position	32.33
Right Hand Steering Right	3 O'clock driving position	43.96
Right Hand Steering Right	6 O'clock driving position	45.58
Right Hand Steering Right	9 O'clock driving position	45.35
Right Hand Steering Right	12 O'clock driving position	16.14
Left Hand Steering Left	3 O'clock driving position	21.16
Left Hand Steering Left	6 O'clock driving position	33.72
Left Hand Steering Left	9 O'clock driving position	25.35
Left Hand Steering Left	12 O'clock driving position	15.54
Right Hand Steering Left	3 O'clock driving position	33.26
Right Hand Steering Left	6 O'clock driving position	16.74
Right Hand Steering Left	9 O'clock driving position	16.98
Right Hand Steering Left	12 O'clock driving position	29.77
Brake Force		
Left Hand Forward		35.00
Right Hand Forward		54.65
Left Hand Aft		40.63
Right Hand Aft		48.61
Left Hand Up		8.75
Right Hand Up		26.46
Left Hand Down		26.46
Right Hand Down		4.79
Twisting Force		
Left Hand Forward		2.22
Left Hand Back		2.72
Right Hand Forward		.22
Right Hand Back		2.16
Grip		
Left		1.33
Right		3.67
Reaction Data		
Reaction Time	Left Hand	.57
Detection Time	Left Hand	.20
$\bar{X}$ Force Reaction Time	Left Hand	39.58
Reaction Time	Right Hand	.73
Detection Time	Right Hand	.30
$\bar{X}$ Force Reaction Time	Right Hand	33.53

Conclusions and Discussion

An analysis of the data collected in this investigation revealed findings described earlier. These findings suggest:

1. Individuals vary widely in strength capabilities due to different diseases and injuries. Generally, the higher the spinal injury the lower the strength results; the more severe the neurological impairment, the lower the strength results.
2. The 9 o'clock steering wheel grip position offers the best force driving position. This finding refutes previous beliefs that it is always best to drive with the right hand, brake and accelerate with left hand. If only concerned with maximum steering, the 9 o'clock steering position must be considered. In the automobile, the person would be able to support the elbow on the left door arm rest when in a normal driving situation.
3. The aft force direction of the hand control, used for braking test, offers the best direction for braking force. Contrary to current hand control design, the study found that the more strength force is produced in the aft direction than in the forward pushing direction. This could suggest that equipment companies need to change braking force direction. However, comfort and ease of use must be considered.
4. The twisting forward action of the hand control offers the most favorable direction for maximum force. Although twisting forward produced favorable results, the awkward action that was required to obtain positive force would limit its usefulness.
5. Reaction times were slower than expected but were above the minimum .24 seconds. They exceeded the time period which is generally acceptable for able bodied drivers. The reaction times ranged from .20 seconds to over one second. Those who had longer reaction times were subjects suffering from a closed head injury. Other persons with slow reaction times were victims of upper spinal cord injuries, quad-polio, and major neurological impairments.
6. A majority of the subjects tested were unable to exert enough force to stop a vehicle under emergency driving situations (100 force pounds or more). Fifty-two of fifty-four means were below those required for stopping. This finding is of major importance for it suggests a greater emphasis must be placed on emergency driving techniques and braking techniques. If the subject is unprepared for such a situation, the probability of being involved in a braking related accident is greater.
7. Hand dominance plays no significant role in steering force, braking or grip.
8. Grip plays no vital role in steering and the braking tasks. No evidence was found to suggest that grip is a vital function in order to attain a better steering or braking force score.
9. Victims of severe spinal injuries and neurological diseases generally produced the poorest results. These subjects had major impairments and had difficulty with all strength related tests. This finding suggests that there is a need for more "less effort" driving systems so as to enable more minimum

strength persons to drive modified vehicles.

10. The 12 o'clock grip position should not be used as a driving position based on strength capabilities and the awkward steering action. Subjects consistently complained about the uncomfortableness of the twelve o'clock position.
11. Although not practical, a driver could be instructed that the best strength direction is steering clockwise. Therefore, if the driver had a choice of steering in either direction, he could choose the clockwise direction. There was a significant difference between the directions of steering force.
12. Due to the muscle groups required and the awkwardness of the action, the upward force direction should not be used for either the braking or accelerating action on a conventional hand control driving system. Subjects would often try to rest their arm on their legs so as to obtain a better result when trying the upward force test.

Recommendations

On the basis of the data resulting from this investigation, the following points are recommended:

1. Persons who are suspected of having any general physical weakness should be thoroughly tested and screened before driver education instruction begins. By testing the subject prior to driving, time and effort can be saved in the determination, pro or con for driving.

2. Further testing and research is required to clarify the relationships between specific diseases and injuries regarding force capabilities. Are spinal injured persons less likely to become drivers than neurologically impaired drivers?

3. Repeat the tests but have categories of diseases and injuries rather than grouping them all together. Too much of the lower input levels get hidden within the data.

4. Repeat the tests using larger populations of physically handicapped subjects. There is a need to gather data on a more diverse group of subjects. A comparison needs to be made between complete spinal cord injured subjects and incomplete spinal cord injured subjects. There needs to be more known about the degree of injury and its relationship to driving.

5. Repeat the steering wheel test using five different grip devices to determine if one or more devices offers improved steering results.

6. Repeat the reaction time test using a more accurate electronic timing device. Many devices would have to be explored in order to determine the most effective and efficient.

7. Study the effects obtained on the testing device with the actual driving success of the physically handicapped individual.

INCONTINENCE - A DISABLING PROBLEM

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MERRY JO DALLAS

ABSTRACT

The management of incontinence is an important aspect of daily living for any person experiencing this problem. In order to assist incontinent persons and caregivers, research efforts have focused on determining existing problems in managing incontinence and best solutions for those problems. Interviews with nursing directors, caregivers and incontinent persons shed considerable light on problems in managing this disability. To choose satisfactory solutions, the incontinent person and/or caregiver must be 1) aware of products designed for incontinence, their availability and cost, and 2) knowledgeable about the performance of various types of disposable and reusable products. The product evaluation includes an investigation regarding the ease of application, ease of removal, odor containment, maintenance of normal skin condition, urine retention, overall product aesthetics, and personal comfort. Consumers should not be limited to choosing only disposables or only reusables; they should be able to choose the right combination of features for the individual's maximum psychological and physical well-being.

Introduction

In 1979, Mandelstam (1979) estimated that there were between 8 and 9 million persons in the United States who suffered from incontinence, based on the incidence of incontinence in England. These incontinent people include elderly and handicapped people you may know, as well as inconspicuous people--your neighbors, your co-workers, yourself. Frequently, these persons are not readily identified because incontinence, or a lack of control over the bladder or bowels, is a condition that has been "kept in the closet" by the medical profession, by the media, by societal attitudes, and by afflicted persons themselves.

Recent advancements in the technology of products associated with incontinence are surfacing in national television, magazine, and newspaper advertising. Perhaps national attention to "toxic shock syndrome" and the resulting need to develop improved sanitary pads has paved the way to greater acceptance of the problem of incontinence and the use of sanitary pads to manage minor leakage problems. Developments in sanitary napkin products, such as the use of extra absorbent fibers, lightweight waterproof fabrics, and adhesive anchor strips, have been used in some of the newer incontinent products designed for the older child and adult. Advertising for all of these products has begun to bring incontinence "out of the closet", although the word "incontinence" is never mentioned. These ads often show well-dressed suburbanites, usually elderly men and women, feeling free to play golf or attend card parties in their "dependable" oversized and extra-absorbent pad. In addition, toddlers are shown in ads "talking" to mom about the comfort and ease of wearing the latest in disposable diapers. The new larger sizes and extra absorbency may imply use with larger children or small adults.

Statistics on the consumption of disposable products and advertising slogans lead layman to believe that diapers are not only disposable, but indispensable. Many nursing homes use disposable products; it has been found that disposables now enjoy a 60 percent lead over cloth reusable products (Chanko, 1983). Disposables have become a way of life for today's moms. Eighty percent of hospital newborns wear them home (Pacific News Service, 1983) and the "premie" disposable diaper has been newly developed. Ads expose consumers to new developments like the "hourglass" design, elasticized legs and waists, and adhesive tapes that replace pins and can be fastened again and again.

Frequently, new products solve one problem, but create new problems. Sealing off wetness is suspected to promote overhydration and irritation of the covered area. More skin rashes and bed sores may occur with these sealed disposables than with the use of cloth products. Disposing of disposables is suspected of contaminating landfills and water supplies (Pacific News Service, 1983). The sterilization of cloth or reusable products would control these health problems, but most home washing and drying practices are not adequate to stop bacterial growth. Diaper services and commercial laundries are "self-regulated" to provide sanitary products, but these care practices may be too harsh for anything other than old fashioned 100% cotton cloth diaper.

It is popularly thought that cloth products are more cost effective than disposable products because they can be reused, even though initially a reusable adult diaper costs ten times more than a disposable ($5.66 versus .59). Considerations of convenience, the availability of laundry facilities, the cost of laundering, sensitivity in handling, and embarrassment may override the long term cost savings of reusables.

Previous Research

Research efforts in the management of incontinence have been underway in England since, at least, 1968. In that country, specialty panties for the incontinent have been available through a variety of sources. Two innovative models, at that time, were the Kanga pant, a reusable panty with a disposable pad fitted into a water-proof pouch, and a gelulose pad used like a sanitary pad, pinned to reusable panties or tied to a belt. Development of similar products in the United States seemed to lag behind England. As late as 1980, products similar to those available in England were limited.

In response to the apparent lack of satisfying products and to the lack of knowledge regarding products and sources of procurement on the part of the incontinent patient and families, Dallas and Wilson (1981) undertook a study to develop comfortable, functional and aesthetically satisfying panties for physically handicapped women and girls with adaptations for the special needs associated with self-help and urinary incontinence. Designs and adaptations were developed to provide for the management of urinary incontinence featuring improved fit and comfort, and simplified dressing and undressing, especially during toileting. The modification of commercial panties to accommodate individual needs and preferences provide greater acceptance than "specialty panties" that appeared too different from current trends. Adaptations had the further advantage of requiring less sewing skill on the part of the women and girls or their families. Various types of diaper-like inserts were developed, including one which incorporated a knitted olefin covering, this provides a dry layer against the skin, yet allows the urine to pass through the fabric to pads of highly absorbent materials. It was apparent that the solutions to panty problems required an individualized approach. Continued experimentations with products and designs yielded a proto-type combining preferred features derived form an earlier preference study of new materials and modifications of diaper-like inserts.

A more recent study concentrated on the evaluation of a commercially available disposable product in an institutional setting (Beeber, 1980). Dr. Beeber and staff divided 276 totally incontinent patients into two groups. A control group of 127 subjects continued to receive their usual care, while the test group of 149 patients wore a disposable brief as their only incontinent care product. The staff monitored the physiological aspects associated with wearing the brief for comparison to the usual care procedure. The usual care included the use of disposable bed pads, frequent clothing and bedding changes, and make-shift cloth diapers. Bedding and clothing protection, skin dryness, patient comfort, convenience, ease of application, ease of removal, and odor containment were scored by nurses and aides when comparing the disposable brief to conventional care. Nurses also assessed the patients' perceptions. Of the 149 who wore the brief in the test phase, 53 were sufficiently alert for staff to interpret their responses. Although subjective in nature, the major difference in the control and test groups was the perception that the quality of life improved in 40 out of the 53 patients who wore the brief, because they had increased mobility and reduced embarrassment. The staff preferred the brief because it reduced their workload, helped patients by allowing them more independence, and improved the odor, appearance, and mood of the ward. This study, which evaluated the use of a popular disposable brief, appears to be an exception to more common evaluation practice, on word-of-mouth comments from nursing staff or aides. Other caregiving companies may seek little or no user feedback.

Focus of Current Research Efforts

Although the incidence of urinary incontinence was felt to be significant in the general population (Mandalstam, 1979), and a major problem with disabled persons (Dallas and Wilson, 1981), the National Institute of Ageing (1981), targeted the elderly as a group that would greatly benefit from studies related to the management of urinary incontinence. It was projected that urinary incontinence affects one in ten persons over 65 years of age and is an important factor contributing to institutionalization (NIA, 1981). A current study by Dallas and Wilson, funded by the American Home Economics Association in 1982, focuses on elderly women in nursing homes for the development of a base of information that may be generalized to all women disabled by urinary incontinence. The objectives of this study are 1) to determine the incidence of incontinence among elderly women in nursing home settings 2) to determine management practices and products used in these homes, 3) to determine satisfaction levels with these products both from the standpoint of the nursing home and the patient, and 4) to assemble examples of currently available disposable and reusable products as a basis for the development of an informational package. It is hoped this package could be used by incontinent persons as well as caregivers to aid in the selection process of products that meet individual needs.

Methodology and Resources

In January 1982, the six nursing homes in Fort Collins, Colorado, were selected for the study. Nursing directors at each of the six homes were interviewed to determine the extent of urinary incontinence among their female patients and to collect data specific to management practices, products used, reasons for product selection, care practices for reusable products, and estimated costs associated with maintaining the incontinent patient. Of the six directors interviewed, four expressed a willingness to continue with the study. In each home, nurses and/or caregivers were asked to complete a questionnaire for each female patient experiencing urinary incontinence. The questions developed a patient profile that included evaluation of the degree incontinence, degree of assistance in dressing and toileting activities, and general well-being. In addition to the profile, product performance, judged by the nurse or caregiver, was determined for each product used with each patient. Products were evaluated on the following basis: ease of application, ease of removal, odor containment, maintenance of patient's normal skin condition, urine retention capacity of product, overall aesthetic qualities of product and comfort to the patient. Eighty-seven questionnaires were completed, coded, and analyzed (Statistical Package for the Social Sciences, SPSS). Frequency distributions were produced for each question.

Results and Discussion

Initial interviews. The nursing directors of the six care facilities gave substantial insight into the problems associated with the management of incontinence in predominantly elderly female patients. Out of 391 female patients in the six homes, 195, 49.8%, were identified as incontinent. This figure was consistent with an earlier study by Dallas and Wilson (1981) and with figures reported in an unpublished paper on the proceedings of a workshop on urinary incontinence in the elderly sponsored by the National Institute of Ageing (1981).

The methods used for the management of this problem varied. Four of the six facilities used a bladder training program together with various products designed to manage incontinence. According to the directors, the degree of incontinence, the patient's mobility, and the cost of products were the main determinants in the choice of products used by the homes. It appeared that a wide variety of products were in use.

From the four nursing homes that continued in the study, additional information was collected regarding the costs associated with the management of their incontinent female patients, preferences of the home for disposable versus nondisposable products and laundry practices used by the homes for reusable products. Generally, the costs of products were included in the overall patient care cost. Some private patients purchased products directly, from the home or other sources. Costs per patient per day varied among the homes and depended on the types of products in use and the number of required changes per day. It appeared that the nursing homes paid different amounts for the same product, dependent upon supplier used and the volume being purchased. Costs were estimated by the directors to range from $6.00 per day per patient for disposable bed pads to $12.00 - $15.00 per day for disposable pads used with reusable briefs. ATTEND brand briefs averaged $.51 per change.

The reasons given for preferences between disposables and reusables were stated as lower cost, less odor, patient psychological well-being, patient physical well-being, and convenience. It was apparent some directors felt that disposables were of lower cost than reusables. If feeling was justified by any formal analysis was not known. The questions posed were open ended, thus the directors could volunteer any responses they desired. One director noted that her home was considering a change to reusables based on information that a reusable brief-disposable pad system was more cost effective than disposables. This change has not yet occurred. However, the director is still considering the idea. It appears that homes have an increase in interest in product selection since this study began two years ago. If the home used reusables, the director was asked how the products were laundered. Practices varied, but one consistent requirement was the heating of wash water to at least 165F. This factor, plus the use of industrial strength washing aids, shortens the useful life of most reusables.

Questionnaires. Questionnaires were completed for 87 patients. The patients were not evenly distributed among the home with some having a higher population of incontinent females. Also, homes varied in the number of caregivers willing to take part in the study. Patient ages ranged from 29-95. Fifty of the 87 were chair-bound and three were bed-bound. The bladder rehabilitation potential was judged "poor" in 58 percent of the 87 patients. The type of incontinence was recorded using definitions of each type to assure each caregiver used the same criteria. Reflex incontinence was the most prevalent type in 51 out of 87 patients. Forty-four percent of the patients were on a bladder rehabilitation program involving the regulation of liquid intake and two home checks of the patient. Some patients are not suitable candidates for this training program due to the severity of their incontinence or other health related reasons.

In some instances more than one product was used by a patient. For example, bed pads would be used at night and disposable briefs or diapers during the day. The number of changes required ranged from 1-2 changes per 24 hour period to as high as 9-10 changes. Thirty-six of the 87 patients, 41%, were changed 7-8 times per day. Colorado law requires that the patient be changed every two hours, if necessary.

Questions related to general health revealed that pressure sores and skin irritation on the lower torso did occur in some patients, but were not considered a serious problem. Most patients required assistance in dressing and toileting activities. Since patient attitudes are important factors in the study, the caregivers were asked to describe and rate the patient's general attitude toward the products used in managing their incontinence. Fifty percent of the patients were identified by the caregivers as not sufficiently alert and/or cognizant to be able to evaluate the products. A common response was that the patient is in a general state of confusion. To ascertain the patient's level of activity, a question was asked about participation in nursing home activities as well as activities outside the home. Outside activities were limited in many instances, which may or may not have been related to the patient's incontinence.

Table 1 shows the products in use by the 87 patients. Only the ATTENDS brief, reusable bed pad and the POLY GUARD 11 disposable bed pad were used by large enough numbers of patients to justify further analysis.

TABLE 1

PRODUCTS IN USE WITH 87 FEMALE
NURSING HOME PATIENTS IN FOUR INSTITUTIONS

Products	NO	YES
Tranquility Pad	86	1
Attends Brief	24	63
Attends Pad	81	6
Reusable Bed pad[a]	55	32
Poly Gard II Disposable Pad	75	11
Kotex Pad	83	3

[a] various tradenames were being used

Table 2 shows the product evaluation for the ATTENDS brief which was used by 63 of the 87 patients. Generally the ATTENDS brief was evaluated as "good." The evaluation of urine retention was most varied. It received a larger number of "excellent" and "poors" than the other criteria. It is not known what products have been used in the past that may have served as a basis for comparison by the cargivers.

TABLE 2

PRODUCT EVALUATION OF *ATTENDS* BRIEF
USED BY 63 OF 87 PATIENTS

Criteria	Poor	Fair	Good	Excellent
Ease of Application	6	19	33	5
Ease of Removal	2	18	38	5
Odor Containment	0	8	52	3
Maintenance of Skin	2	12	42	7
Urine Retention	7	11	31	14
Overall Aesthetics	2	10	48	3
Comfort to Patient	3	10	47	3
Totals	22	88	271	40

While the ATTENDS brief was an acceptable management alternative for 63 incontinent women in four Fort Collins nursing homes, caregivers stated that for certain mobile and active residents, a reusable product might be a desirable alternative. Many of these patients preferred to select and use products which they could care for themselves. One lady was observed laundering the disposable products she had been using. Several women were aware that the disposable products were adding non-recoverable costs to their care.

Research in Progress

A pilot study to compare the merits of disposable and reusable products was undertaken. To date, five women have participated. The women were each shown a collection of currently available reusable and disposable products and asked to select products or indicate product features they felt would meet their needs. Products were then purchased or prototypes constructed for each woman. Concurrently the women were asked to identify and weigh the criteria used in the selection of products for the management of incontinence. Such criteria as appearance, comfort, maintenance, cost, odor containment, and absorbency were listed. A wear schedule for two or more products was then established. After a trial wear period, the researcher, patient and/or caregiver were asked to evaluate the performance of each product based on the predetermined criteria. The performance for each product worn was then measured by assigning values to the selection criteria and performance rating using a system reported by Smith and Block (1982). While the results of these wear studies have not been analyzed, the product, source, and 1984 cost for each item are listed by type (see Appendix). They have been grouped by purpose according to manufacturer's suggested use. More products are listed than have been evaluated to date.

Summary

The ongoing research of Dallas and Wilson has focused on the incidence of incontinence among elderly women in nursing homes, satisfaction with current practices in the management of incontinence, new developments in disposable and reusable products, and the evaluation of satisfaction with current practices from the patient's viewpoint. The ultimate goal is to inform consumers who are managing this problem. It is assumed that consumers should not be limited to the use of only disposables or only reusables, but should be able to choose the right combination of features to provide individual solutions.

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Appendix

INCONTINENCE PRODUCTS

TYPE/TRADENAME	DESCRIPTION	MANUFACTURER	PRICE[a]	RETAIL OUTLET OR OTHER SOURCE
STRESS[b] RELATED				
A. Liners				
1. Depend Shield	Disposable panty liner with adhesive strips	Kimberly-Clark Corp. Neenah, WI 54956	Reg. size 12/$2.49	Sears Pharmacies Discount stores
2. Sears Disposable Liners Regular	Adheres to panties or brief	Sears, Roebuck & Co. Chicago, IL 60684	Reg. size 50/$8.49	Sears
3. Sears Plastic Back Reusable Liner	Snap in lining used with Sears brief	Sears, Roebuck & Co.	$7.99 *	Sears
4. Attends Panty Liner	Disposable liner. Adheres to panties	Procter & Gamble Cincinnati, OH 45202	$.50 *	Institutional supplier
5. Dri-Pride Content II Pads	Disposable pad with vinyl backing	Dri-Pride Division-Weyerhaeuser Corp. Freemont, MI 49412	96/$17.50	Sales rep.
6. Dri-Pride Content II with adhesive strip	Disposable pad with vinyl backing	Dri-Pride	96/$21.75	Sales rep.
7. Dri-Pride Content Pads	Disposable	Dri-Pride	Med. size 96/$14.95	Sales rep.
B. Briefs				
1. Depend Undergarment	Disposable open side brief with reusable elastic strap and buttons	Kimberly-Clark	Reg. size 30/$15.49	Sears Pharmacies Discount stores
2. Attends	Disposable incontinent brief	Procter & Gamble	Sm.-12/$5.99 Med.-12/$7.49 Lg.-12/$10.99	Sears Pharmacies

TYPE/TRADENAME	DESCRIPTION	MANUFACTURER	PRICE[a]	RETAIL OUTLET OR OTHER SOURCE
B. Briefs (cont.)				
3. Sears Incontinent Brief. Used with Liners A.2,3	100% polyester knit drop-front and snap up sides or pull-on	Sears, Roebuck & Co.	$10.00	Sears
4. Mesh Stretch Brief - Used with liners A.2	Reusable brief of nylon elastic	Sears, Roebuck & Co.	3/$4.99	Sears
5. Sears Ribbed Knit Brief Used with Liners A.2	Reusable brief of nylon and spandex	Sears, Roebuck & Co.	3/$5.99	Sears
6. Tranquility Brief and Pad	Brief-reusable Pad-disposable	Principle Business Enterprises, Inc. Dunbridge, OH 43414	Starter set: 1 brief & 5 pads/$12.00 Brief-$8.99 Pads -25/$12.99	Pharmacies
7. Futuro Patient Aids	Reusable plastic pant; disposable liner	Division of Jung Products, Inc. Cincinnati, OH 45202	Starter set: $17.92 Pant-$8.90 Liner-25/$11.02	Pharmacies
8. Dignity	Reusable cotton brief; disposable pad	unavailable	Starter set: 1 brief & 5 pads/$14.95 Pads-25/$9.86	Pharmacies
9. Sears Pant & Liner	Reusable pant-100% tricot; disposable liner with Super-Sober adheres to pant	Sear, Roebuck & Co.	Pant-$4.99 Liners-25/$6.49	Sears
10. Dri-Pride 100% cotton Pant and Pad	Reusable pant with drop front and snap-up sides; disposable pad	Dri-Pride	Pant-$8.50 Med. size pads-72/$22.95	Sales rep.
11. Dri-Pride Content Pants	Reusable pant used with liners A.5,6,7	Dri-Pride	Pant-$7.50	Sales rep.

* * *

URGE[c] RELATED

C. Liners				
1. Depend Shields	Disposable panty liner with adhesive stripe	Kimberly-Clark	Super-12/$4.99	Sears Pharmacies Discount stores
2. Sears Disposable liner	Super-Sober polymer; adheres to brief	Sears, Roebuck & Co.	25/$6.99	Sears
3. Attend Panty Liner	Disposable liner adheres to panty	Procter & Gamble	$.50	Institutional supplier
4. Sears Plastic-Back Reusable Lining	Snap in lining used with Sears brief	Sears, Roebuck & Co.	$7.99	Sears

TYPE/TRADENAME	DESCRIPTION	MANUFACTURER	PRICE[a]	RETAIL OUTLET OR OTHER SOURCE
C. Liners (cont.)				
5. Dri-Pride Content Pad	Disposable pad; holds up to 850 c.c. urine	Dri-Pride	Heavy-96/$25.50	Sales rep.
D. Briefs				
1. Sears Incontinent Brief Used with A.2,3 C.2,4	100% polyester knit with drop-front, snap-up side or pull on	Sear, Roebuck & Co.	$10.99 *	Sears
2. Sears Best Incontinent Brief	100% nylon tricot-vinyl coated, cotton flannel lining; drop-front with snap-up sides or pull on. Used with C.4	Sears, Roebuck & Co.	$15.99 *	Sears
3. Mesh Stretch Brief Used with C.2	Reusable brief of nylon elastic	Sears, Roebuck & Co.	3/$4.99	Sears
4. Sears Ribbed Knit Brief	Reusable brief of nylon and spandex; used with C.2	Sear, Roebuck & Co.	$3/5.99	Sears
5. Kanga Incontinence Pants and Pad	Reusable pant with drop-front and Velcro closure and disposable pad	Kanga Hospital Products Ltd. P. O. Box 39 Belmont Road Bolton, BL7, 9QN	Pant-2/$5.54 Pad-1pkg/$5.40	Home nursing Supply Headquarters Road West Wilts Trading Estate Westburg, Wilts England
6. Depends Undergarments	Disposable open side brief	Kimberly-Clark	Super-30/$18.99	Sears Pharmacies Discount stores
7. Attends Briefs	Disposable briefs	Procter & Gamble	Sm.-12/$5.99 Med.-12/$7.49 Lg.-12/$10.99	Sears Pharmacies
8. Dri-Pride Content Pant	Reusable pant; used with liner C.5	Dri-Pride	Pant-$7.50	Sales rep.
9. Dri-Pride 100% Cotton Pants/Pad	Reusable pant; drop-front and snap-up side; disposable pad	Dri-Pride	Pant-$8.50 Heavy pad-72/$25.50	Sales rep.
10. Dri-Pride Vinyl Pant	Reusable pant	Dri-Pride	Pant-$8.00	Sales rep.
11. Dundee Reusable Incontinent Brief	Reusable brief-100% cotton, Absorba-fil & Barigard; drop-front and snap-up closure	Dundee Mills, Inc. 111 West 40th St. New York, NY 10018	Sm.-$13.00 Med.-$15.25 Lg.-$17.85	Institutional sales rep.

TYPE/TRADENAME	DESCRIPTION	MANUFACTURER	PRICE[a]	RETAIL OUTLET OR OTHER SOURCE
D. Briefs (cont.)				
12. Unigard Incontinent Pants	Disposable pant; drop-front and snap-up closure	Medical-Surgical Div. Parke Davis & Co. Detroit, MI 48232	unavailable	Sales rep.
E. Diapers				
1. Sears Disposable Incontinent Pants	Super-Sober; adhesive tabs	Sears, Roebuck & Co.	10/$5.99	Sears
2. Sears Incontinent Brief	Disposable brief with elastic legs; adhesive tabs	Sears, Roebuck & Co.	10/$6.99	Sears
3. Sears Adult Diapers with Absorba-fil	Reusable diaper; Bari-gard backing	Sears, Roebuck & Co.	3/$45.99	Sears
4. Ambees Adult Diapers	Disposable; adhesive tabs	unavailable	10/$11.00	Pharmacies
5. Dri-Pride Adult Diaper	Disposable diaper open sides, reusable tape closures	Dri-Pride	Sm.-96/$39.50 Med.-96/$43.50 Lg.-96/$47.50	Sales rep.
6. Dundee Adult Containment Pads	Reusable diaper; 100% cotton; Absorba-fil and Bari-gard	Dundee Mills	$8.00 @	Sales rep.
7. Dundee Adult Snap Containment Pads	Reusable diaper; elastic waist back; snap-up closure	Dundee Mills	$8.00 @	Sales rep.
8. Unigard Incontinent Pads	Disposable diaper	Parke, Davis & Co.	unavailable	Sales rep.

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[a] Prices may vary from outlet to outlet.

[b] Stress incontinence is termed as an occasional discharge in small quantities caused by activities that stretch lower abdominal muscles and put pressure on the bladder such as coughing, laughing, stooping or sneezing.

[c] Urge incontinence is an involuntary emptying of bladder with or without warning. This type of incontinence may occur several times a day or night and is generally associated with nerve or physical impairment.

REAL TIME / REAL BEHAVIOR
USING A MICROCOMPUTER FOR EVALUATION AND TRAINING

CHARLES H. SANTEE

ABSTRACT

This presentation emphasizes the need for the inclusion of an evaluation mode in most, if not all, instructional software. It points out the computer's role in simplifying the visual observation of behavior in an instructional setting. The author presents a series of programs showing the development of more sophisticated evaluation techniques. The presentation focuses on two pieces of software. The first software program used to map and reinforce motor patterns for physically handicapped persons. The second program was designed to simplify observation in any instructional setting, and to assist in recording the frequency and duration of up to 60 simultaneous events.

Recording the observation of behavior can be an error prone activity. Observation of certain types of behavior can be extremely difficult, if not impossible. The author demonstrated the development of two programs; developed, hopefully, to advance the science of measurement by the application of microcomputer technology.

Observation Station

Observation Station is a microcomputer program designed to assist in the recording of direct visual observation of behaviors. The program user can define up to twelve individuals and up to 6 different behaviors (or if desired up to 72 individual events). The file of behaviors and individuals can be saved on disk for future use. At the cross section of the matrix of individuals and events shown on the video screen is a character. This character (or key) is pressed on the keyboard to indicate that the behavior described for that individual has been initiated. The character is pressed once again when the behavior has terminated. The computer records the beginning and ending time of the behavior. The operation of this program is similar to those of 72 individual stop watches recording observations. After the instructor or observer terminates an observation period, they can call up a written report of the following information:

1. The frequency of each behavioral episode.
2. The average duration of behavioral episodes across the observation period.
3. An adjusted frequency count which would estimate the expected frequency of occurrence for a standard time period. (i.e., how many times might the behavior be expected to occur in an hours period.
4. The average frequency and duration for one behavior across individuals.
5. The average frequency and duration for one individual across all behaviors.

In addition, the program allows the control of recorded or synthesized sound or music as a medium of reinfor-

```
THIS OBSERVATION BEGAN AT 00:00:00

THIS OBSERVATION ENDED AT 00:02:20

THE OBSERVATION LASTED 140 SECONDS

                                              BEHAVIORS
                                   ----------------------------------
NAME       MEASURE             TALKING  EYE CON                              AVERA
----------------------------------------------------------------------------------
ABLE       count                  5        2
           adj. count           128.57    51.43                              90.00
           duration              10.60    13.50                              12.05

BAKER      count                  4        3
           adj. count           102.86    77.14                              90.00
           duration               8.50     7.33                               7.92

CHARLIE    count                  3        1
           adj. count            77.14    25.71                              51.43
           duration               8.00    22.00                              15.00

----------------------------------------------------------------------------------

AVERAGE adj. count              102.86    51.43

AVERAGE duration                  9.03    14.28
```

cement while the observation is taking place. Through a "Plug'n'Power" device, electrical apparatus in the external environment can be used as potential sources of reinforcement.

MOVER
Movement Mapping and Diagnosis

This software allows the creation of a visual map of the subject's movement through space. The individual is attached to a joystick with a piece of elastic. The software allows the user to create any desired pattern as a target for movement training. It can be used to evaluate the motion of individuals performing meaningful tasks in sheltered workshop settings such as bench assembly. The printout includes the number and percentage of "hits" to a designated pattern, if desired. An additional statistic is the average amount of movement that occurs within regularly sampled intervals. This provides a highly precise measure of the speed and accuracy of individual movement for any specified movement pattern.

Conclusion

These two programs briefly highlight some unique measurement applications, the untapped potential of the microcomputer as a tool for assisting in existing measurement, and the expanding use and role of measurement into new areas. Some of the programs developed by this author may be reviewed in a column the author writes on a monthly basis titled "The Educated Guest" in "Hot Co Co," a computer magazine written for the Radio Shack Color Computer. The program "Observation Station" was created by the author to run on the Radio Shack Color Computer, The Radio Shack Model III or IV. and the IBM - PC. For further information on this program write:

Dr. Charles H. Santee
8 S 045 Grant
Westmont, IL 60559

REFERENCES

Santee, C. H. (Dec. 1983 - October 1984) The Educated Guest (a column on educational computing), Hot Co Co, Peterborough, New Hampshire.

A COMMUNICATION SYSTEM FOR THE NON-VOCAL PHYSICALLY IMPAIRED PERSON

HOWARD LAMBERT

ABSTRACT

The program WRITEIT/SAYIT is a communication aid for non-vocal persons who cannot operate a typewriter keyboard. To use WRITEIT/SAYIT, one must be able to activate any one of four switches corresponding to the inputs 0, 1, 2 and E(enter). (See "System Requirements" below.) Letters, numbers, punctuation, words, and whole sentences of the operator's own devising may be selected using these four inputs. These selections are remembered by the computer and spoken by the voice synthesizer. Also, WRITEIT/SAYIT can be used to learn how to read since the selections can be repeatedly displayed on the screen and spoken by the voice synthesizer.

Operation

When the program WRITEIT/SAYIT is started, the operator is asked if instructions are needed. If they are, the following instructions are printed on the screen and spoken by the voice synthesizer:

> Remember, when you are most anywhere in the program select E for next page or to continue.
>
> Select 0 and E to return to the main menu.
>
> Select 0 0 and E to have choices spoken. (The current screenful of possible choices will be spoken by the voice synthesizer.)
>
> Select 0 0 0 and E to remove your last choice.
>
> To make a choice, select the numbers next to what you want followed by pressing E.
>
> The following main menu will then appear on the screen:

```
 1 = YOUR STORAGE SPACE
 2 = WORDS
10 = LETTERS OF THE ALPHABET
11 = NUMBERS AND PUNCTUATION
12 = UTILITIES
```

Item Selection

Each possible choice is listed together with its corresponding code number. In order to select an item, the operator selects the keys that correspond to the item's code number followed by selecting E(enter). For each activation of the 0, 1 or 2 key, the corresponding number is stated by the voice synthesizer. The fifth key is a backspace, but the operator may remove an incorrect choice of a code number by adding any choice of numbers until the whole number starts over again (no code number is larger than three digits). By pressing 0, 0 and E, each screenful of choices will be spoken by the voice synthesizer. Each section of the program that the operator enters is identified by the voice synthesizer and all of the operator's selections are displayed and spoken.

Available Selections

The operator's own choices are in YOUR STORAGE SPACE (select 1 and E from the main menu). In the WORDS section (select 2 and E from the main menu) there is a basic word list of approximately 300 words and an extended word list of approximately 2700 words. (The selection of a word is based on knowing the first letter of the word in the basic word list section and knowing the first two letters of the word in the extended word list section.) The letters of the alphabet are in LETTERS OF THE ALPHABET (select 1, 0 and E from the main menu) and numbers, punctuation and other symbols are in NUMBERS & PUNCTUATION (select 1, 1 and E from the main menu). The UTILITIES section (select 1, 2 and E from the main menu) enables the operator to start over, print out his or her choices (obtain a hard copy), switch between the basic word list and the extended word list and to add or remove items from YOUR STORAGE SPACE.

Example

Suppose the operator wants to write the following message:

MY ADDRESS IS 108 OAK ST.

Step 1 Clear everything that has been selected so far and change to the extended word list if necessary.

Step 2 Go to WORDS and select MY, ADDRESS and IS then return to the main menu.

Step 3 Go to NUMBERS & PUNCTUATION, select a blank space, then select 1, 0, 8 and a blank space. Return to the main menu.

Step 4 Go to LETTERS OF THE ALPHABET and select O, A, K, a blank space, S and T. Return to the main menu.

Step 5 Go to NUMBERS & PUNCTUATION and select the period. Return to the main menu.

If desired, the operator may now save this selection as one item in YOUR STORAGE SPACE. The operator may also want to practice seeing and hearing MY ADDRESS IS 108 OAK ST. This can be done by repeatedly activating the E key from the main menu.

Changing Files from the Computer's Keyboard

Using the computer's keyboard directly, another program called CHANGE (on the same diskette as WRITEIT/SAYIT) allows a helper to add or remove items from YOUR STORAGE SPACE and the basic or extended word lists.

System Requirements

The system demonstrated consists of the following components:

1. Radio Shack color computer with 64K of memory and extended BASIC.
2. One disk drive.
3. VOTRAX voice synthesizer.
4. Radio Shack TP-10 printer.
5. Comrex Monitor.
6. Modified Prentke Romich special 5 key keyboard. (The modification is to allow the keyboard to plug into the right joystick port on the color computer.)

In general, the special 4 (or

5) key keyboard may be any device that inputs a different voltage to the right joystick port for each key activation.

The total cost of this system was approximately $1,600.

Summary

WRITEIT/SAYIT is already being used successfully by several cerebral palsy victims who cannot speak and cannot operate an ordinary typewriter keyboard. Also, one of the victims cannot read, but since most of WRITEIT/SAYIT is spoken by the voice synthesizer, she is using the program to learn this skill too.

USER ACCEPTANCE OF A ROBOTIC ARM

MARGO K. APOSTOLOS

ABSTRACT

The purpose of this study is to explore user acceptance of a robotic arm. The focus of this project was an assessment of attitudinal changes of selected quadriplegics in response to the presentation of two orientation programs on the use of robotic arms. One program included a discussion of aesthetic sequences of robotic movement, industrial design, and kinetic art. The other program in contrast, presented the 'standard' introduction to the robotic arm which involved utilitarian sequences of robotic movement.

This study used an industrial robotic arm. This manipulator aid has been programmed for use by quadriplegics as a personal assistant in a rehabilitative setting. Thus, the potential users of this study are disabled individuals.

The whole study is a series of investigations of the hypothesis that aesthetic movement of a robotic arm can affect an individual's attitude toward the acceptance and use of robots. The aim of the project is to develop a positive relation between man and machine. This exploratory research is being conducted in collaboration with the Rehabilitation Research and Development Center of the Veteran's Administration Hospital of Palo Alto.

Introduction

An increase in the number and uses of working robots has presented the problem of user apprehension and possible anxiety in relation to these mechanical instruments. Apprehension and anxiety are factors which contribute to the significance of this study of user acceptance of robotic arms. Investigation of consumer reaction and user acceptance of everyday utilitarian products has been the work of industrial designers. The work in this field merges art and technology, as demonstrated through the relationship of utility and appearance in the design of commonly used products. The Bauhaus School of Design had a tremendous impact on industrial design, art, and architecture. At the Bauhaus, artists and engineers worked together to demonstrate a unity of art and technology through the visualization and experimentation of design from both aesthetic and utilitarian aspects. Kinetic art, as an outgrowth of the Bauhaus, represents the effect of scientific and technological progress in a creative and abstract sense. The works of kinetic art are symbolic representations of the unity of art and technology.

An aesthetic orientation program has been developed to sensitize potential users of the robotic arm. The aesthetics session will feature a visual display illustrating the evolution of robots, the products of industrial design, the influence of the Bauhaus, and works of kinetic art.

The Robotic Arm

This study will investigate the movement of an industrial robotic arm, also referred to as a robotic manipulator aid. The robotic arm used in this study is located at the Rehabilitation Research and Development Center at the Veteran's Administration Medical Center in Palo Alto, California. This system is an industrial manipulator-PUMA 250 by Unimation with six degrees of freedom. The system is operated in Val driven by a Z-80 based zilog micro-computer system which also recognizes voice command and hand control (joystick).

The robotic arm consists of a shoulder, arm, wrist, and hand (interchangeable grippers) with a minimum of three articulations:

1) extend and retract
2) swing and rotate
3) elevate and depress

The wrist has increased range of movement with the ability to bend, roll, spin, and swivel. The arm has three paths of motion and three of the wrist which provide a total of six degrees of freedom. The robotic arm is characterized by the ability to perform with repeat ability, reliability, high speed performance, precision, and accuracy. For this study, the robot arm will remain mounted to a stationary tabletop base, although a mobile base is available.

Rehabilitative Robotics

The idea of a personal robot has been applied in a medical, rehabilitative setting. Dr. Larry Leifer of the Rehabilitation Research and Development Center and Professor of Mechanical Engineering at Stanford University has identified the application of advanced robotic technology for severely disabled persons in:

1) activities of daily life (eating/hygiene)
2) personal clerical tasks
3) vocational tasks
4) recreation

Dr. Leifer (Leifer, 1981) has used the robotic arm in a rehabilitative setting to give the severely disabled person more direct control of personal space and a greater feeling of independence.

The purpose of using a robotic arm to assist the disabled is based on the idea of replacing the function of the missing limb and not its anatomy: Thus, the robot is not to be confused with a prosthetic device. The robotic manipulator aid has been an experimental device used with quadriplegic patients. Quadripegia, the paralysis of four limbs, impairs the individual's ability to manipulate. This condition is a typical result of traumatic spinal cord injury with damage to the cerebral cortex, which controls the hand/arm function. The individual is without sensation and muscle control in the torso and legs and with little muscle control or sensation in the arms. Leifer reports that the higher brain stem controls are usually not damaged from the paralyzing injury and the quadriplegic is generally without impaired mental functions. Severely disabled persons may be physically impaired but mentally alert; thus, the use of an advanced technological instrument appears to be a feasible alternative.

The man/machine interface is of paramount concern in adapting the robotic arm by the quadriplegic patient as a personal assistant. The robot must be viewed as a helpful instrument rather than a harmful threat. Leifer reports, "The usefulness of artificial limbs had been limited mainly by inadequate sensory feedback. Movements performed without sensory feedback are awkward. Visual feedback of gross limb displacement is not as easy to manage as kinesthetic feedback." The visual feedback fatigues the user because of the constant attention level (Leifer, 1981).

Leifer also states, "As the robot processes human input, the information transfer between man and machine must be carefully managed. Every physical disability reduced our capacity to transmit, receive, or process information. Therefore, we should have the user specific goals, the system attempt to achieve these goals, and the user supervise the system's operation" (Leifer, 1981). The robotic arm as a personal assistant to the quadriplegic is controlled by the patient through a voice control mode. The OMNI Book of Computers and Robots reported, "The first household robots may also debut as caretakers for invalids. Unimation, working with researchers at Stanford University, is attempting to modify a Puma robot to understand simple spoken commands to aid paraplegics" (Davies, 1982).

The use of the robotic arm as a personal assistant has a significant role in establishing an independent living environment. Attendant care for the physically disabled is an area of concern (Crewe, 1983):

> personal care is one of the first areas of human activity in which an individual learns to become independent. Yet it is still one of the last areas in which a severely physically disabled individual can become fully independent. To be dependent in the care of one's own body is to renounce much of one's personal autonomy. To manage one's own personal care is to reclaim one's sense of worth.

Barbara Angius of the Rehabilitation Research and Development Center has reported, "Recreation tasks provide a challenging and motivating way to redevelop skills and provide leisure activities for the disabled person. Devising creative robotic applications for recreation will be among the major objectives in the future research and evaluation of the robotic manipulator for the severely disabled" (Angius, 1983). Angius describes specific recreational tasks targeted for user application as the control of board games, painting, video games, and dance choreography.

This case study features dance choreography for a robotic arm as part of an experimental treatment program in the attitude assessment study. Choreography, as demonstrated through aesthetic sequences of the robotic arm may enhance creative discovery in a non-utilitarian sense.

The aesthetic characteristics of the movement will be identified by defining various criteria of the aesthetic patterns of movement. The identification of these aesthetic characteristics of robotic movement is largely a subjective appraisal. While specific criteria have not been established to determine the aesthetics of robotic movement, this study is based on differentiating a practical utilitarian approach and a non-practical choreographic approach in introductory sessions for use of the robotic arm. The use of a robotic arm to perform utilitarian tasks as designated by specific computer programs is common. The 'work' of the robot is often demonstrated by the efficient, staccato type movement sequences which are devised from an aspect of efficiency rather than an immediate aesthetic appeal. Robotic movement that is designed to be functionally efficient is not always aesthetically pleasing.

As part of this project an attempt was made to present aesthetic movement of a robotic arm, in the form of choreographed sequences of robotic movement synchronized with music. The mechanical features of the staccato action of the robotic arm are contrasted with "aesthetic" maneuvers. The aesthetic features a more sustained effort in the actions, smoother transitions from point to point, more curved lines replacing many of the straight and sharp angular motions, and a varied sequence in the timing of movement sequences to break up the constant speed characteristic of the practical patterns of movement. The aesthetic maneuvers explore the related movement elements of the action quality, flow, shape, and timing in various movement phrases.

In this project, the integration of the sounds of music, the forms of sculpture, and motions of dance was sought. The choreography of synchronized robotic movement has been developed as part of the experimental aesthetic orientation session and demonstrates the aesthetic dimension of the robotic manipulator aid. Choreography, the art of making dances, uses dance as a series of rhythmic motions in time and space to express ideas through movement. Dance and choreography suggest direct human involvement in the programming of movement sequences for the robot; however, a "dancing" robot and robotic "choreography" may be used only as a metaphor. The choreography for a robotic arm combines the logical approach of science with the sensuous approach of art in a blend of artistic-scientific creativity.

The idea of "de-humanized dance" is not entirely foreign; the 1960 works of American choregrapher Alwin Nikolais were based on this concept. The Nikolais dancers moved in mechanical imagery, virtually stripped of their human identity through technical effects. The dancers were manipulated through space and time by the controls of this master choreographer. The idea of computerized choreography can be compared with the notion of "chance design" in dance as demonstrated by the collaborative efforts of choreographer Merce Cunningham and composer/musician John Cage. The Cunningham/Cage style has influenced the experimentation of computerized dance choreography.

Experimental Design

Overview

This study examines the effects of two orientation programs on potential users of a robotic arm: one based on the currently used conventional lecture and another based on an aesthetic approach added as a supplement to the conventional program. The investigation is being conducted in collaboration with the Rehabilitation Research and Development Center of the Palo Alto Veteran's Administration Hospital. The purpose of this study is to assess user acceptance of a robotic manipulator aid.

The hypothesis of this study is that the aesthetic orientation, based on a visual presentation which features the principles of industrial design, the Bauhaus, kinetic art, and synchronized robotic movement will improve the impact of the orientation program by affecting individual attitudes toward the use and acceptance of a robotic arm. Attitudinal change, measured by a pretest and posttest, will reflect the effect of these two orientation programs on the subjects involved in the study.

In Phase 1 of the study, the conventional orientation session included an introduction to the robotic manipulator aid through a lecture based on the practical and utilitarian aspects of this device. The aesthetic orientation session was based on a lecture, individualized instruction, slide presentation, and videotaped segments designed to sensitize members of the group to the robotic arm. Each session was approximately thirty minutes in length. A follow-up study, Phase 2, will explore the effect of the aesthetic orientation on the actual training program for use of the robotic arm.

Two subjects are participating in the training procedures for use of the robotic aid. Robotic choreography will be attempted by trainees. These subjects will actually attempt to use the arm in a simple aesthetic performance. A post-posttest will follow the training and choreography sessions.

Interpretation of the Projected Findings

The results of this study should indicate whether an aesthetic orientation to the robotic arm and follow-up practice session, where the arm is used to perform aesthetic movement sequences, can affect user acceptance of this instrument. The aesthetic orientation is not intended to replace the conventional session but to expand the scope for the introduction to the robotic arm. An aesthetic approach which includes a visual display, and the actual choreographic training may be valuable in improving attitudes generated in user acceptance and overcoming robot anxiety.

Educational Implications

The robotic arm has been used by quadriplegics in everyday settings to gain an independent control of their living environment. The aesthetic dimension of robotic movement can perhaps influence the adaptability of potential user acceptance of this robot.

The aesthetic implications may exceed the impact of the attitudinal influences suggested by this study. The method of synchronized robotic movement, as machine choreography, may be further developed as a form of creative expression for the physically disabled. While the artistic and therapeutic values of this robotic instrument and the subsequent method of synchronized robotic movement have not been established, the possibility of extending the use of the robotic arm into an instrument of aesthetic and creative channels must be pursued.

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STRATEGIES FOR A FUNCTIONAL URBAN PARATRANSIT SERVICE

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ABSTRACT

San Francisco, like other urban centers, has had many policy discussion confrontations over adequate transportation services for the disabled and the elderly. Fragmented attempts to provide services has failed because of inadequate training, faulty equipment, escalating maintenance and service cost and a failure of public institutions to develop a comprehensive policy on access, use, and management. The San Francisco Public Utilities Commission and the Police Commission initiated discussions on the perimeters of these problems.

In this limited study, the participant-observer is a user of Paratransit Services and, thus, provides a unique vision of the handicapped-traveler in San Francisco. In this study, the Luxor Paratransit Services providing transportation services for the elderly and handicapped through the Department of Community Medicine U.C.S.F., will be reviewed. Planning continues to improve overall service with special focus on hospital utilization, outpatient services, and extramural activities that enable the handicapped to participate more fully in the enriched activities of San Francisco.

The paratransit program also reviews the training and capabilities of all staff, comprehensive routine maintenance of all vehicles, and the use of two-way radios with back-up from emergency units.

The program's major barrier is limited resources for meeting the needs of the great numbers of handicapped and elderly citizens who now require these services. Continued expansion of these services will elicit collaborative strategies; strategies initially, undertaken to provide the highest degree of accountability, sensitivity to the unique needs of handicapped and elderly persons and safety, and convenience.

Some recommendations are: a uniform survey of the handicapped population, a demand drivers system based on defined standards of service and reliability, a Comprehensive Training and Screening program with national standards for drivers, use of a simplified dispatch system based on direct communication, and the formulation of a nationwide paratransit broker network with a toll-free 800 number.

San Francisco: The Setting

San Francisco travelers enjoy several transit advantages. It is a compact 49 square miles, nestled on the tip of a peninsula no more that seven miles on each side. It has a moderate climate, kept within a few degrees of cozy sixty-to-eighty degree temperature by the warm Pacific Ocean; this makes the outdoors enticing. Sweltering heat and freezing cold are almost unknown. A visitor to this city may be uncomfortable if unprepared for the fog; it can be chilly to people in sun shorts, but quite normal to those accustomed to its regularity. It rains in the winter when San Franciscans think it should. Annual precipitation is about 22 inches.

The public transporation system is inexpensive and reliable, running on a twenty-minute schedule; it is convenient to the able-bodied traveler, providing a network of cross-connections throughout the city. Distances are so abbreviated that the annual cross-city "Bay-to-Breakers" race, from the Ferry Building on the waterfront to the city's beach by the Pacific Ocean, has perennially attracted thousands of runners. Last year an estimated 80,000 hardy runners made the course.

San Francisco's hilly terrain is a major disadvantage to travel. Providing lofty views of all the Bay Area, and creating a scenic backdrop to local sights, San Francisco's many steep, precipitous streets wreak havoc on brake linings, gas mileage, and the short-winded pedestrian.

Problems for the Disabled

For the estimated 80,000 disabled citizens in wheelchairs, on crutches, and using canes, the city's rugged hills make it impossible in some areas, to traverse the two or three block distance to the nearest bus stop.

Public municipal transportation, with modern wheelchair lifts and computerized schedules, claims to provide mass transit for everyone's needs. However, it overlooks the disabled person unable to get to the bus stop, or, as in so many cases, is unable to go from the bus stop to the hospital clinic, bank, or store. The people having the greatest need for adequate mobility, thus have gone without until the governing fathers put aside debates about cost-effectiveness, "the greatest public good," and other limited ideas, and considered the plight of the disabled traveler.

"How," they might ask themselves, "does a person on crutches walk downhill without falling breaking his nose?" And, "what if someone's wheelchair loses its brakes and crashes downhill into a tree,...or veers into the path of an oncoming vehicle?"

Accessibility Needs of the Disabled

The issue is clear. San Francisco is a beautiful city, worth enjoying. There are 35 legitimate theaters, 6 cabarets, 8 night clubs, a dozen symphony, opera, and ballet auditoriums, and 31 downtown movie theaters (50 more in the neighborhoods). Three ferry boats run to Marin County, Angel Island, and Alcatraz. There are more than eight municipal piers from which to fish. Outdoor concerts can be held almost anywhere, from Golden Gate Park to Aquatic Park to Candlestick Park. At Candlestick, in season, can be seen the sometimes champion Forty-Niners and Giants. The city has five commercial television stations and one PBS station; all welcome guests to their studio audience. There are so many restaurants, it would take years of every night dining before you needed to return to a restaurant. The cuisine is as varied as the faces in a crowd: epicurean Italian or French cooking, Mexican food, Spanish food, Chinese, Japanese, or Vietnamese dishes. There is the five-mile long, manmade Golden Gate Park, with trees, plants, and flowers from all over the world; 19 museums, 75 art galleries, 3 universities, and 8 colleges.

There is much to do in San Francisco, and much reason for getting involved. Academicians from increasing disciplines have stressed that immobilization thru isolation may produce EEG abnormalities and widespread impairments of intellectual and perceptual processes in adult experimental subjects. This has important implications for advocates of improved access by disabled persons to the outside world. Nothing is gained by society or if disabled persons stay home and vegetate. A stimulating environment activates forces within disabled persons that may lead toward natural recovery. This holds promise for those who wish to return disabled persons to productive, tax-paying lives in our society. It seems obvious in a city with the rich diversity of San Francisco, that fulfilling this return to society lies in providing a viable paratransit service for disabled citizens.

The Problem of Mobility on a Limited Budget

With such a beautiful city and bountiful activity devices it seems that anyone, including the long-neglected disabled, would be highly motivated to find access.

There seemed to be no viable alternative to mass transportation because of the difficulties cited. As the existing paratransit service was limited to medical visits only, the only alternative was taxi service. Only the affluent can afford to pay for this taxi travel, now costing $1.30 to enter the cab, and $1.20 for every mile thereafter. At this rate, a short trip downtown might cost six or seven dollars.

Some disabled persons were very clever in accessing transportation. They, frequently, joined the city recreation centers for handicapped persons to receive the free ride to the center. They then skipped the center's activities, boarded a cab, and went shopping in stores closer to the center than to their own homes, thus economizing on cab fare. Other people used taxi scrip meant for medical visits, got off at the doctor's office near shopping centers, and paid for a cab to go shopping. Since they often chose stores near the doctor's office, they paid a minimum in cab fare and realized a great savings.

A Limited Paratransit Van Service

A publicly supported van service has meanwhile appeared, seeming to answer the needs of the disabled in San Francisco. Sponsored by the city and a subsection of a neighborhood community center, the vehicle was equipped with a tailgate lift to transport persons in wheelchairs. Supported primarily by federal funds, these van services were nearly free to disabled riders, but had major limitations.

1. The rider had to reserve their ride several days in advance, and, therefore, could make no last-minute changes in plans;
2. Passengers rode in groups. They were picked up and dropped along a prescribed route, so the riders had no assurance of arriving at their destination on time. Any delays along the route accumulated, a few minutes here, a few minutes there, making any ride a test of patience because the vans ran so agonizingly far behind schedule;
3. The vans were very old and had seen many miles before being converted to paratransit use with a bubble top and a wheelchair lift. Breakdowns plagued many because inadequate maintenance had let the vans deteriorate until they were wobbly, coughing hulks of metal sadly reflecting the low esteem in which eighty thousand disabled San Franciscans were held, sitting on ripped-open seats amidst choking fumes;
4. No communications existed between the vans and the dispatching office. A driver could not report a breakdown or a delay. More importantly, they could not get help in an emergency;
5. The system was not cost effective. Because of unreliable service. Passengers used this means of paratransit less than the company had anticipated; the budget ran in the red, and the city became dissatisfied with its contracted service.

Improved Paratransit Van Service

As a result of inappropriate services, the City's Public Utilities Commission and the Police Commission initiated discussions, public hearings and Community Task Forces to better define the acute needs of disabled and senior citizens. Surveys, expansion of senior Escort Services, and Orientation meetings with Hospital Outpatient Services and Clinics, focused on the continuing problems of access, use services and staff training. The basic issue remained: the lack of a functional paratransit van service to give the highest degree of access and service networking needed for this unique population.

Luxor Paratransit Van Services became one provider to undertake this challenge for San Francisco. This Paratransit Van Service has three years to demonstrate that the problems can be resolved. In its first year, Luxor is making an effort to avoid the mistakes that made prior service unreliable. The vans they purchased were brand new, top of the line, and made specifically for the job; nothing like the broken down old nags used in the past. Each van has a radio link to the dispatcher, and easy patch-in to police communications and emergency services. Since vans are large, rolling metal ovens when subjected to the sun's hot rays, each van is equipped with air conditioning. The interior of the vans were carefully planned for comfort, giving special care to the handicapped rider. Seating is provided for three ambulatory passengers, leaving three floor positions for wheelchairs. The passenger seats are plush, soft, and comfortable, fitting the stereophonic sound from the van's radio. Comfort, reliability, and safety were of paramount importance in the selection of the vans. They did not come cheap. The new vans were expensive, thus, Luxor started with four vans, far fewer than the sixteen, reconditional previous vans. Planning for improved service is based on attracting more clients and adding to the number of trips per month, thus increasing revenue from the city. Four vans would be enough because breakdowns would not be a problem with the rigid, preventative maintenance program planned. Shop time would be short, each van down for inspection and service only minutes at a time. Dents or scratches would be repaired and repainted immediately. No van would appear on the streets looking shabby, like the prior ones. Washing, waxing, and vacuuming of the vans was to become as important as keeping them supplied with gas, oil, and water. The four vans, of the first year have now been expanded to a fleet of seven, plus four reserve vehicles.

Schedules are punctual and, because of a two-way radio, allow for last-minute changes and emergencies. Now, a rider needs only to reserve a day in advance, opposed to the two-day requirement of the previous contractor. Also, because of improved scheduling, it is possible for a client to be picked up or dropped off anywhere in the city, at any time, for whatever reason. A disabled person, using this new system, is now able to visit any of the previously detailed joys of the city; and they need not be lonely when going out, for Luxor Paratransit Van service allows a person to accompany the disabled rider. This person does not need to be a paid attendant, but can be a date, a relative, or a spouse.

On a space available basis, a person can go on short notice. This brings the practical lead time down to twelve hours. Emergency situations can receive even faster service than the practical limit.

The key to this success is a clear communication hookup between driver and dispatcher. The former contractor's system used an order-taker to answer the phone, putting a buffer between the client and the dispatcher. This caused some agonizing delays and some frustrating moments. Luxor's system allows a quick yes or no response directly from the dispatcher. Callers no longer hear the discouraging and too familiar "I'll let you know later," often the equivalent of "no", because the caller frequently hung up in disgust.

Selection and Training of Drivers

Luxor's paratransit van drivers are chosen for their proven experience and reputation as passenger carriers. As an added criterion, a prospective driver is sent on a run accompanied by two of Luxor's regular van drivers. The driver's attentiveness to traffic and courtesy to passengers is evaluated.

After a basic orientation to the company's goals, services and operations, the new driver participates in a Sensitivity Training Workshop conducted in two four-hour sessions by a personable, recovered former m.s. paraplegic who (as shown in Table 2 Sensitivity Training Workshop) teaches body language, facial expressions, and communication with deaf or learning disabled persons. The training helps the driver think and feel like a disabled person, thus able to anticipate many needs. Drivers are also taught to maneuver the van as closely as possible to the destination point, and to assist the disabled person out of the van and into the building, even carrying the client if necessary.

The radio system provides excellent back-up by police, fire, public health and marine services. Under this system, a driver can respond to an emergency call in which a disabled person is stranded by a run-down wheelchair battery or bent wheel, pick up the wheelchair, get it to the wheelchair shop for repairs, and return it, ready for use. This year, a frequent user of this paratransit system, a spinal cord injured wheelchair patient was NOTIFIED at home that her mother had been injured at the Laguna Honda Home (for the elderly) and was being taken to San Francisco General Hospital by Ambulance. The daughter called the Luxor Paratransit Dispatch, who in turn called the Police Dispatcher and Hospital Services Unit. By the time the mother was brought by ambulance to the trauma center her daughter had already arrived by paratransit and she met her mother with the trauma unit special team!

To maintain valid oversight Luxor requires drivers to be on time for pickup 95% of the time or have their pay docked (Table 2). Users of this service are encouraged to contact the Chief Dispatcher of Luxor Systems, the Public Utilities Commission, Director of Special Projects, or the San Francisco Police Permit Unit regarding comments or concerns on the quality of service.

Table 2

PARATRANSIT DATA: July 1, 1983-June 30, 1984

Contractor	Cost	#trips	shared rides	# lift-assisted	participants	reported reliability
A	$266,225.84	45,603	45,603	--	950	100% 15 min
B	307,871.60	59,023	59,023	--	575	99.46%
Luxor Van Service	311,606.28	20,158	--	20,158	400	97%
D	624,223.04	135,852	21,690	--	1,365	85%
Totals	$1,509,926.70	260,636	126,316	20,158	3,290	

Broker	135,000.00
Total	$1,644,926.70

Service Cost and the Demand Drivers System

A sample sheet of statistics for August (Table 3) reports 1,350 clients at a cost to the city of $116,284. This overall monthly figure reflects the 86 rides a day at the equivalent of 15 cents per trip.

Table 3

Statistics for August - 1984

Total Clients	1358	$116,284
10%	1231	106,554
50%	127	9,730

Average Limit: 85.6

II. Number of wheelchair clients certifies = 458

Number of active lift-van users = 115

III. Males = 510 Females = 1155

Each rider is expected to pay 40 cents a ride or to purchase a monthly pass for $2.50. Under Luxor's Paratransit Service, passenger usage has increased resulting in a decrease in overall operating costs. The justification for this expense to the city is easily made. Every one of the disabled persons in San Francisco is a potential asset to the city, especially if recovered, employed, and paying taxes. An investment made now in this area, is likely to return its benefits in time of need. After all, don't we put a great deal of money into fire hydrants, not expecting everyone to go into service extinguishing fires, but to have one around when it is needed.

As a summary of costs: The first contractor made 600 runs a month; Luxor has as many as 2,542, lowering the per unit cost and resulting in a savings of $1,500,00.

Summary

San Francisco has made significant access headway with the unit on Paratransit services. Even though, contractors are not required to provide 24 hour service on holidays, service, contractors like Luxor Van Service do provide them. The independent variable continues to be the driver-dispatcher and client interaction. Direct communication based on continued training and performance standards are the basics for the implementation of a functional Urban Transit system.

Although handicapped and elderly persons have more degrees of freedom in regard to the use of transit services today, key areas must be addressed to insure the highest degree of access, utilization and performance.

Recommendations

1) Initiate and maintain hard data on this unique population using proven survey techniques;
2) Formulate Regional Demand Driver System based upon uniform service and reliability standards;
3) Formulate a Comprehensive Training and Screening Program with National Standards and Accreditation. Core areas include, Vehicle Safety, Communication Techniques, Sensitivity Training, Stress, and CPR units, Police and Zoning Requirements, and Driving Techniques;
4) Institute Hospital and Service Facility orientation for drivers, police, and hospital personal to increase continuity of services, minimum wait time and enforcement procedures. Quarterly inspection of vehicles by appropriate government agencies;
5) Use a simplified dispatch system based on direct communication.
6) Establish a nationwide paratransit broker network to facilitate access of transport services

regardless of region or sector of the country. Development of a toll-free 800 number for facilities and local systems.

Coordinated Inter-Paratransit Service of the Future

Paratransit service can become much more valuable to the disabled if expanded from one city to intercity travel. Consider how much better attended this conference might have been (Discovery '84, Chicago, Ill., October 1-3, 1984), and the vast improvement to the quality of the conference, if disabled persons were provided smoothly operating information and facilities. Suppose that computer terminals existed to tell the disabled traveler what to expect at his or her destination in terms of accessibility, luggage handling, airport van service, and accessible hotels and restaurants. The disabled traveler of the future ought to be able to rely on reservations that automatically take into account his special needs. Cooperative scheduling between cities could let the disabled traveler move from one city to another without noticing much difference. The day is near. We have the technology at hand and simply need to use it.

Table 1
SENSITIVITY TRAINING WORKSHOP

GOAL: To raise the awareness of those persons servicing the needs of the elderly and handicapped. Who they are, what they're like, what they need and how to best serve them.

I. Body mechanics/patient handling
  A. Your body and how to use it properly
    - simple anatomy and illustrations
    - what happens to your body when you're driving all day

  B. Transporting, transferring and seating your clients (hands on experience)
    - wheel chair from curb to street, street to curb
    - w/c up and down ramps, walkways and steps (3 to 4)
    - loading clients onto and off van or vehicle
    - safety measures

  C. Escorting mobility impaired persons, those with assistive devices, the blind and hard of hearing
    - on the stairway
    - on a hill
    - boarding and de-boarding

  D. When the client starts to fall down
     What do you do?

II. Communications (verbal and non-verbal)
  A. Identifying hidden disabilities
  B. Experiencing disability and limitations
  C. Language barriers
  D. Common problems and how to deal with them
  E. Expectations of the driver by the client

- F. Expectations of the client by the driver
- G. Facts vs. fiction about the elderly and handicapped
- H. Dealing with the difficult client or behavioral problem
- I. Making the client feel comfortable and secure
- J. Conversing with the elderly/handicapped
- K. What is patience and understanding?

III. Stress management and reduction

- A. What is STRESS?
- B. The effect of stress on your body
- C. How stress affects the people around you
- D. How stress is expressed/manifested physically
- E. Various exercises, methods and strategies to alleviate stress (that can be done in a few minutes)

ENABLING HANDICAPPED NONREADERS TO INDEPENDENTLY OBTAIN INFORMATION: INITIAL DEVELOPMENT OF AN INEXPENSIVE BAR CODE READER SYSTEM

ALAN VANBIERVLIET

ABSTRACT

A large number of mentally retarded, physically handicapped, and visually impaired persons are unable to obtain information from the available symbol systems (i.e., printed words and numbers). Those individuals remain unduly dependent upon other for their information needs. The primary purpose of this project is to evaluate an inexpensive, reliable, portable bar code reader that transcribes printed bar code into synthetic speech. These bar code readers will enable handicapped persons to independently gain information and retrieve seldom-used or forgotten information. For example, this technology will enable handicapped nonreaders to "read" recipes, menus, first aid instructions, bus schedules, and board game rules. For many years, this technology has been used to obtain reliable information for merchandise inventory and sales. This project will first evaluate the durability of the reader and the intelligibility of its synthetic speech. Following these experiments, the efficacy of using the bar code reader as an aid in learning meal preparation and emergency skills will be examined using a combined alternating treatments and multiple baseline design. In addition, the device will be evaluated in regard to its usefulness as a teaching aid for handicapped readers using an alternating treatments design. The use of a bar code reader as an efficient, self-operated information retrieval device appears promising and deserves careful development and evaluation. Bar code readers have the potential for increasing the independence of a large number of handicapped individuals. This project represents the first examination of the application of bar code reader technology as a practical aid for handicapped nonreaders.

Importance of Program

Written language and other standard symbol systems are available to most individuals for obtaining information. A large number of handicapped individuals, however, are functionally illiterate of their ability to gain information from the available symbol systems. This includes many mentally retarded, physically handicapped, visually impaired, and other handicapped persons. Sartain (1976) has estimated that 13 to 15 percent of the population of the United states is illiterate. Without the use of a functional symbol system, many handicapped persons will forever remain unduly dependent upon others for their information needs. Most available self-instructional aids in daily living (e.g., cookbooks), work (e.g., automotive manuals), and leisure (e.g., board game rules and theater schedules) are designed to be read, thus perpetuating the handicapped nonreader's dependency.

The development of an effective system for independently gaining information from a variety of sources is a critical need for many handicapped persons who cannot read. These individuals need a means to gain new information and retrieve seldom-used or forgotten information.

Alternative Information Systems

Braille:

Braille has been developed as an alternative symbol system to circumvent some of the debilitating effects of visual deficits. However, Braille requires very fine tactile discrimination skills. It has been estimated that only about 4 percent of the legally blind individuals in the U.S.A. learn to effectively use Braille (American Foundation for the Blind, 1981).

Pictorial instruction:

One alternative symbol system that has been successfully used to teach moderately and severely handicapped individuals is called picture reading or pictorial instruction. Pictorial instruction involves teaching individuals to obtain information and instructions from simple pictures sometimes accompanied by printed words (Spellman, DeBriere, Jarboe, Campbell, & Harris, 1978). When cued by pictures, learners are taught to select items, perform specific actions, "read" the pictures in an ordered sequence, and perform actions in the order depicted. Learners who have acquired the skills to follow pictorial instruction may be able to use picture books to solve problems and to learn new tasks. Picture books can also be used as reminders of how a task is performed. Pictorial instruction has been used successfully to teach a wide range of skills including: meal preparation (Johnson & Cuvo, 1981); Martin, Rusch, James, Decker, & Trtol, 1982; Robinson-Wilson, 1977), housekeeping skills (Spellman et al., 1978), schedule and calendar skills (Spellman et al., 1978), public transportation skills (Vogelsberg & Rusch, 1980), and vocational skills (Wacker & Berg, 1983). Although many moderately and severely handicapped individuals have learned to use picture skills, some younger and more severely handicapped individuals never learned to use the picture cue system (Spellman et al., 1978). As an alternative symbol system, pictorial instruction has several disadvantages. These are: 1) many actions and objects are very difficult to depict by a picture or photograph; 2) some individuals do not learn to translate pictorial symbols into actions; 3) the system is of little benefit for severely visually impaired persons; and 4) currently there are neither standard rules governing what symbols to use nor rules concerning the syntactic arrangement of the symbols.

Audio cassette players:

Another procedure for obtaining information is to store the information on cassette tapes which can be played back at any time. Perera and Cobb (1978) described the Learning Through Listening Project which used tape-recorded materials for teaching visually impaired students. The "Talking Book" system also uses this procedure. Many visually impaired persons use cassette players to store and retrieve information on a daily basis (e.g., university students use this procedure for taking class notes). This procedure enables handicapped individuals to access information in a wide variety of settings with reliable, inexpensive equipment. The primary disadvantage of this alternative is that the searching and scanning skills that are necessary to find a particular piece of information on a tape are too complex for many handicapped persons.

Hi-tech converters:

Several devices have been developed to convert text into either auditory or tactile stimuli for visually impaired persons. Examples of these devices are the Kurzweil Reading Machine which produces synthetic speech from printed materials (Goodrich, Bennett, De L'Aune, Lauer, & Mowinski, 1979; Selvin, 1981) and the Optacon which produces a tactile stimulus to the reader's fingertip (Moore & Hunt, 1981; Thurman & Weiss-Kapp, 1977). These devices, however, are fairly fragile, require considerable skill and training to use (particularly the Optacon), and they are beyond the financial range of most handicapped persons (costing from $3,000 to $52,000).

Bar code readers:

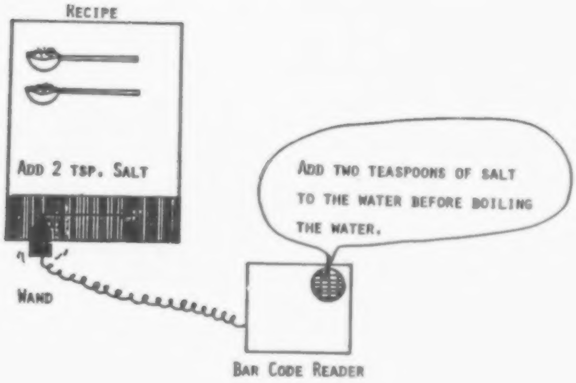
Another strategy for effectively obtaining information from a variety of sources is the use of bar code reader technology. For many years this technology has been used to obtain reliable information for merchandise inventory and sales. Basically this system involves passing a light sensitive pen or laser over a printed code containing bars of varying thickness which correspond to coded numbers. This bar code can be printed anywhere on an item. Information regarding the product that is stored in the machine's memory can then be accessed and presented via a visual display, printed on paper, or spoken aloud with the aid of a voice synthesizer.

An information system for handicapped persons would consist of a portable device which could "read" printed bar code from a variety of sources. The processing unit would then transcribe the code and auditorily present the information via a speech synthesizer.

FIGURE 1

BAR CODE READERS

INVOLVES PASSING A LIGHT SENSITIVE PEN OR WAND OVER PRINTED CODE CONTAINING BARS OF VARYING THICKNESS. THE DEVICE TRANSCRIBES THE CODE INTO AUDITORY STIMULI.


RECIPE
ADD 2 TSP. SALT
ADD TWO TEASPOONS OF SALT TO THE WATER BEFORE BOILING THE WATER.
WAND
BAR CODE READER

Method

At present, however, there is no application of this technology to the information needs of handicapped persons. The primary purpose of this research project is to develop and evaluate a bar code reader system as a self-directed information and instructional aid for handicapped persons.

Objective 1. To repackage the Magic Wand so that it meets the functional and aesthetic needs of handicapped persons.

The first task will involve putting the Magic Wand mechanism into a smaller less obtrusive package. The new "box" should be no bigger than 10 by 10 by 4 cm. This task can be accomplished by either utilizing commercially available universal boxes, or creating out of plastic or metal a custom built package. In addition, the power source will be converted from 4 D-cell batteries to a more compact battery source.

Objective 2. To examine the performance of the Magic Wand under a variety of climatic conditions.

In order to be a truly useful adaptive aid, the bar code reader must be able to function correctly under a wide variety of climatic conditions. The Magic Wand will be tested under cold (below 0 F), hot (above 100 F), high humidity (99%), low humidity (3%), and at various atmospheric pressures. Performance tests will also be conducted under **fluctuating** temperature and humidity conditions as would occur when moving in and out of buildings. In addition, performance tests will be conducted following shocks and impacts resulting from dropping the device form table height up to ten occasions.

The performance tests will be conducted using simple ABAB designs with each condition lasting approximately 30 minutes. Transcription or misreading errors and the rate of synthetic word production will be recorded under each condition. These results will be compared to the performance data on the Magic Wand which are available from Texas instruments.

Objective 3. To evaluate the ability of learning disabled, visually impaired, moderately handicapped, and severely handicapped persons to comprehend the synthesized speech produced by the Magic Wand.

Over the past few years, there has been a rapid growth in voice response devices using synthetic speech. As the number of products that incorporate voice output increases in the educational and rehabilitation marketplace, there is a great need for data about handicapped individuals abilities to comprehend and understand synthetic speech. At the present time, however, there is very little information in the literature dealing with how handicapped persons perceive and understand synthetic speech. The few research reports that are available deal solely with visually impaired children's and adults' abilities to comprehend synthetic speech (Brabyn & Brabyn, 1982; Goodrich, Bennett, Paul, & Wiley, 1980; Rhyne, 1982; Scadden, 1978). The present research study is designed to extend this line of research by involving learning disabled, moderately and severely handicapped, as well as visually impaired young adults and elder citizens. It is intended that this research project will serve to facilitate the development of a comprehensive series of research activities in this area. The research methods that are described below have been adapated from the procedures that have been used at the Speech Research Laboratory at Indiana University to study the perception of synthetic speech by nonhandicapped children (Greene and Pisoni, 1982) and adults (Luce, Feustel, & Pisoni, 1981).

Twelve learning disabled, twelve moderately handicapped, twelve severely handicapped, twelve legally blind young adults and twelve legally blind elder citizens will participate in this experiment. All participants will have normal hearing and they will be native speakers of English. The learning disabled and visually handicapped persons will participate in a work list recall test, the moderately handicapped persons will participate in a Peabody Picture Vocabulary Test, and the severely handicapped persons will participate in a verb-noun instruction following task. Each of the activities will be repeated on two separate occasions. Four sets of words or phrases will be developed for each separate task. One set will be recorded by a male native English speaker. The remaining three will be recorded via the Magic Wand's speech synthesizer at three different pitch levels.

Objective 4: To evaluate handicapped nonreaders need for a device such as a bar code reader on a national basis.

This objective will be achieved by the development, distribution, and analysis of a questionnaire. The questionnaires, will ask special educators to supply information regarding their students' reading skills, ability to use alternative symbol systems, and their information needs. The information produced by this survey will help guide the development of the bar code reader system.

Objective 5: To develop, implement, and evaluate a program to teach moderately and severely handicapped persons to use the Magic Wand to prepare complex meals.

Three to six moderately or severely handicapped young adults will participate in this Experiment. Pictorial instruction booklets (Johnson, 1977; Staples, 1975) will be prepared for nine different recipes. Bar-code instructions will be created for each recipe. Six recipes will be randomly chosen for training in a combined alternating treatments (Barlow & Hayes, 1979) and multiple probe baseline design (Horner & Baer, 1978). The remaining three recipes will serve as generalization probes. At each leg of the multiple baseline one recipe will be randomly chosen to be taught using a bar code reader procedure and the other will be taught using a pictorial instruction procedure (Spellman et al., 1978). Training will occur on one recipe per school/work day, training will systematically alternate between the two recipes. The number of teacher prompts, the number of independently performed steps, and the amount of time spent on each task will serve as the dependent variables.

Two important questions need to be asked in regards to the true value of a bar code reader system as a self-instructional aid. These are: 1) Whether following training individuals will independently use the reader to facilitate their performance across different types of tasks and settings; and 2) Whether individuals will independently use the reader to obtain reference information after long intervals during which they have "forgotten" how to complete a task. These questions will be answered by conducting unreinforced probes both during the training period and following the termination of training. If the handicapped individual is unsuccessful in these probes, the individual will be trained on a selected probe item. This sequence of probing then training will continue until generalization is evident.

Objective 6. To evaluate the effectiveness of bar coded recipes for use by visually impaired persons.

Twenty visually impaired persons will participate in this Experiment. These individuals will possess cooking skills, however, they will not have mastered Braille reading. Six recipes chosen from a cookbook written for visually impaired cooks will be transcribed into bar code instructions. The bar code will have raised edges so that it can be easily located tactically. Following brief instructions in the use of the device, each participant will be observed attempting to complete the recipe in their own kitchen. Observation data will be recorded including the amount of time spent on the recipe, the number of steps correctly followed, and the number of passes made over each bar code instruction. Following the completion of the last recipe, the participants will be asked a series of questions regarding their satisfaction with the bar code reader system.

Objective 7. To evaluate the effectiveness of bar code equipped restaurant menus for use by visually impaired persons.

Menus at a restaurant near the University Campus will be provided with bar coded information about the selections and prices. Bar code readers will be available at the tables to read the menus. This restaurant is frequented by visually impaired individuals involved in mobility training courses. As part of the mobility training courses the students will be briefly instructed in the use of the bar code reader. An observer in the restaurant will record information on the frequency of use of the devices and the number of passes made over each bar coded selection and price. After six to eight visits, over approximately four weeks, the visually impaired individuals will be asked a series of user satisfaction questions.

Objective 8. To develop, implement, and evaluate a program to teach moderately and severely handicapped persons to adequately behave in emergency situations.

Three to six moderately or severely handicapped young adults will participate in this Experiment. Pictorial instruction booklets will be prepared for nine first aid and emergency procedures necessary for safely living in the community such as care of burns, care of seizures (Matson, 1980), operating fire extinguishers, care of sprains, poison emergency, tornado procedures, burst water pipes, and burglary. Bar-code instructions will be created for each procedure. Six emergency procedures will be randomly chosen for training in a combined alternating treatments (Barlow & Hayes, 1979) and multiple probe baseline design (Horner & Baer, 1978). The remaining three procedures will serve as generalization probes. At each leg of the multiple baseline one procedure will be randomly chosen to be taught using a bar code reader strategy and the other will be taught using a pictorial instruction strategy. Training will occur on one procedure per day, training will systematically alternate between the two procedures. The number of teacher prompts, the number of independently performed steps, and the amount of time spent on each task will serve as the dependent variables.

Objective 9. To evaluate the effectiveness of the BCRS as a procedure for mildly handicapped readers to independently preview a story.

The present Experiment is designed to serve as a pilot study to begin evaluating the effectiveness of the BCRS as a tool for reading instruction for handicapped students. It is hypothesized that the wider the range of proven educational applications of the BCRS, the more likely that costs will remain low, the device will be more widely available for purchase, and the more likely the BCRS will be adopted as a valuable educational tool and adaptive device. Promising findings from this initial experiment will serve as the starting point for the development of a more comprehensive series of research activities.

Several prereading activities have proven to be effective in improving handicapped students' reading comprehension (Sachs, 1983) and oral reading behavior (Rose, 1984; Singh & Singh, 1984; Wong & McNaughton, 1980). These strategies have included the teacher providing short verbal statements about the story (Smith & Hess, 1969), and conceptual statements relating to the theme of the story (Bransford & Johnson, 1972). This Experiment is designed to evaluate the effectiveness of using the BCRS for previewing a story before orally reading it.

Six normally hearing 9 to 12 year old students school-classified as mildly retarded or learning disabled will participate in this study. The study will be conducted in a resource room by the classroom teacher. Stories of approximately 100 words from the school's basal reading series will provide the reading material for the study. The stories will be matched to the students' tested reading levels. Preview scripts for these stories will be prepared and transcribed into bar code. These scripts will be designed to provide a background to the story, provide a brief description of the story, and introduce new words, phrases, and expressions.

An alternating treatments design (Barlow & Hayes, 1979; Kazdin & Hartman, 1978) will be used to compare the effects of two training conditions (see Figure 2). The two training conditions will consist of the student independently previewing the story via BCRS, and the teacher reading the preview script to the student. The design will be limited to only two different training procedures since it has been suggested that the number of independent variables in an alternating treatments design be limited to two in order to facilitate subsequent data analysis (Hartmann, Shigetomi, & Barrios, 1978).

The students' oral reading of the stories will be observed and recorded by the teacher and audiotaped for rating by a second observer. Two mutually exclusive responses will be recorded: oral reading errors defined as a mismatch between text and the child's oral response, and self corrections defined as the child's spontaneous correction of oral reading errors without teacher assistance. Following the completion of a story, the teacher will orally administer a comprehension test. Each test will consist of 12 items evenly divided across four levels of reading comprehension: literal, inferential, evaluative, and appreciative according to Barrett's taxonomy (1976). The reliability and content validity of the comprehension test will be evaluated using the procedures described by Sachs (1983). The resulting data will be presented graphically for visual analysis and statistical tests such as analyses of variance will be conducted.

Objective 10. To determine the preliminary costs and benefits of a bar code reader system in order to associate a dollar figure with the system's outcome.

A major obstacle to the adoption of any new procedure is the cost, or imagined cost, of its adoption; it is incumbent upon rehabilitation and education innovators to provide the estimated cost of adopting their procedures. Accordingly, the costs of the bar code reader system will be analyzed. These cost estimates will include the price of the equipment, costs of producing bar coded materials, and the costs associated with training individuals to use the readers. In addition, savings resulting from the use of the procedures, including savings in training time, staff time, and increases in independence will be estimated.

Objective 11. To prepare a report of the research findings, and to prepare documentation for the training programs that have been developed for the bar code reader system.

This component of the Project will involve writing a final report containing an analysis of the significance of the Project and an assessment of the degree to which the objectives of the project have been achieved. In addition, detailed descriptions and instructions for bar code reader training programs in the areas of meal preparation and emergency procedures will be produced. This program documentation will be written in such a way that someone unfamiliar with the bar code reader system could effectively conduct meal preparation and emergency care training with other handicapped persons.

Objective 12. To disseminate research findings and developed materials nationally.

This objective is directly related to the function of scholarly productivity and the sharing with professionals and other interested persons information, strategies, and technologies that will lead to better services for handicapped individuals. Descriptions of the project and resulting scientific findings will be presented at relevant national and regional conventions. Information about the project will also be published in scientific and practice oriented journals. In addition, information will be disseminated through the ERIC database, and federally funded dissemination projects.

Conclusion

The bar-code reader system should prove to be a time-efficient procedure for promoting self-control and independence. The system provides antecedent stimuli in the form of auditory instructions or information which handicapped individuals can independently manipulate to guide their performance. The bar-code reader system should permit individuals to have greater control over their environments, and reduce the need for major environmental adaptations.

It should also facilitate the generalization and maintenance of new skills. The bar-code reader provides stable discriminative stimuli which handicapped individuals can use to guide their performance across diverse settings, tasks, and time. In addition, the bar-code reader system is potentially efficient because:
a) it is easily used in new tasks and settings; b) it is easily adapted to meet differing information needs; and c) its use will likely produce a reduction in training time. The use of bar code readers as efficient, self-operated information devices appears promising and deserves careful development and evaluation. Bar code readers have the potential for increasing the independence of a large number of handicapped individuals.

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INTEGRATING COMMUNICATION, COMPUTER ACCESS, ENVIRONMENTAL CONTROL & MOBILITY

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ABSTRACT

The technology of today offers the people of our society the opportunity to reach levels of achievement never before possible. We all use machines for communication, transportation and entertainment and in performance of our jobs. Technical aids are also available for people with physical handicaps to help them reach goals in educational, vocational and personal pursuits. Through the use of appropriate aids, individuals who are physically handicapped can realize an overall improvement in the quality of life.

Two primary population groups that can be debilitated by physical disability are:

a) high level spinal cord injury (SCI) and
b) severe involvement with cerebral palsy (CP).

These population groups appear to represent the largest groups with needs in the area of physical disability; people with other diagnoses also benefit from the use of technical aids designed around the needs and capabilities of these two groups. Other disabilities include muscular dystrophy, multiple sclerosis, amyotrophic lateral sclerosis and others.

The needs of these population groups can be divided into four areas:

a) Communication
b) Computer Access
c) Environmental Control
d) Mobility

Of the four areas, communication is by far the most important. For nearly everyone, achievement is closely tied to the ability to communicate. The more effective a person's communication skills, the more promising that person's future. Conversational communication is generally not a problem for the SCI population as they retain their speech. For the person with severe cerebral palsy, communication should be the first need addressed.

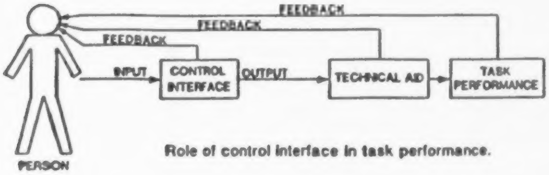
The transition to an information based society has greatly assisted people with physical handicaps. These people were a burden in the days of agricultural or industrial based society. Today, many disabled persons can be productive. A physical handicap does not have to affect a person's ability to access, process and communicate information. Today no person should be provided with a communication system, environmental control or powered wheelchair without considering an access to computers.

After communication and computer access, a person should be provided with a means of operating various appliances in his surroundings. An environmental control system satisfies this need.

Finally, people need to be mobile. Most people with high level SCI and severe cerebral palsy need a powered wheelchair to be mobile. The issue of wheelchair control needs to be addressed.

Control Interfaces

The control interface is that portion of a technical aid or aid system through which the user operates the aid or system. It may be an integral part, as in the case of a built-in keyboard, or it may be a separate component. Figure 1 represents a person using a technical aid to perform a task.



Role of control interface in task performance.

FIGURE 1.

Control interfaces can be categorized in a number of ways. For the purpose of this discussion, they are categorized in two areas:

a) Input from the user.
b) Output to the technical aid.

Input to the control interface is provided by the person. This requires that the person have some controllable capability that can be monitored by the control interface. This capability is usually within one of the following areas:

A. **Physical Movement**
B. **Pneumatic**
C. **Myoelectric**
D. **Sound**

As indicated in Figure 1, helpful feedback can be provided to the user at various points in the performance of a task. One source of this feedback is the control interface. The simple click of a switch that tells the user it has been activated can significantly enhance performance. Tactile feedback of a keyboard, audible beeps and indicator lights are other examples of how this important function can be implemented. As a person becomes familiar with the operation of the device, proprioceptive feedback within the body may further enhance performance.

In some cases, no standard control interface will provide optimum performance. In this situation, a custom unit should be designed and fabricated.

While effectiveness in task performance is emphasized other factors also influence the selection and application of a control interface. These include psychological issues, environment, appearance, set-up time, training effort, maintenance, cost and other practical matters. Frequently, compromises are made between one or more of these factors and the performance of the system. However, since optimal performance should be the primary goal, any compromises should be recognized and communicated to all, including the technical aid user.

Communication

This area addresses the expressive communication needs of people without functional speech. These people, generally, are physically disabled to the extent that they cannot use pen or pencil, type, or sign. Consequently, their ability to express themselves is severely impaired.

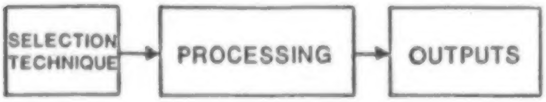
The goal for providing a person with a communication aid should be to achieve the fastest, most effective communication possible. As previously indicated, a person's life achievement is largely determined by his ability to communicate. The process of selecting and applying a communication aid, thus, becomes very important.

Three factors determine the expressive speed of a person using a communication aid:

a) Selection speed
b) Number of selections needed
c) Amount of information retrieved

Selection speed refers to the speed with which the user can make a selection from the array of possible selections. For example, using a keyboard, how long does the user take to locate and activate a key? Number of selections needed refers, to the number of selections that need to be activated to retrieve information. The amount of information retrieved is the last issue. Typical systems might offer only a single letter or other character, a string of characters, words, phrases or complete sentences. All three of these issues determine the rate a person will be able to communicate. Communication can be divided into three areas as indicated in Figure 2:

a) Selection techniques
b) Processing
c) Outputs.



EXPRESSIVE COMMUNICATION SYSTEM

A number of selection techniques have been developed to address the wide range of physical capabilities present in people with severe communication impairment. These selection techniques can be divided into the following classifications:

a) Direct Selection
b) Scanning
c) Encoding

The selection technique that provides the best performance for a particular person will be a function of the physical capabilities exhibited by that person.

For most people with the physical capability to use a direct selection operating technique, it can offer the fastest performance.

While scanning techniques are relatively slow by comparison, they have the advantage of very little physical demand on the user.

Typically, older electronic communication aids were designed to use only one selection technique. Today, aids based on microprocessor technology can operate using different techniques. For both the client and the rehabilitation professional this can be an important asset. When selecting an aid, consideration must be given to the future needs and capabilities of the user. A brain stem injury, for example, may improve physically with time, however, a person with a progressive neurological disorder is expected to lose physical capability. If the communication aid cannot change, it will become useless and/or inappropriate. Processing, the second area in the topic of communication, addresses the way the selection made by the person is used to generate communication.

In the simplest systems, there is no processing. Each selection corresponds to a fixed character or character string. Better systems provide the programming of character strings.

The recent state-of-the-art in commercially available systems is the concept of levels. With this approach, each location in an array of selections could have many meanings. The primary meaning, referred to as the base level, could be retrieved with a single selection. However, any of the other meanings could be retrieved by first selecting a new level, then selecting from within that level. This would correspond to having an entire vocabulary in a book, for example of 100 pages, each with 128 entries. The first page would be fixed and offer access to the ASCII character set. The other 99 pages would have entries of character strings built from the first page. While this system has proven to be functional, it does have limitations that were not immediately obvious. A major fault is the difficulty for the user to remember where particular strings have been stored. The concept of levels and location (pages and entries) is not conducive to memory; it is too arbitrary.

A generalized concept called abbreviation expansion has been promoted by the Trace Center, University of Wisconsin, Madison. This system is an attempt to better match a person's natural language process. With this approach, frequently used, longer character strings are represented by short character strings. For example, "Hello. How are you?" could be represented by "HH?".

Another system, called Minspeak, has been proposed by Bruce Baker, a linguist now working in this field. Minspeak, now commercially available from the Prentke Romich Company, is a further attempt to speed communication by making use of normal language processes.

Minspeak is based on five basic principles:

- a. Full sentences contain more information than smaller units of communication.
- b. Much of a person's routine communication needs can be satisfied by a set of carefully chosen fixed sentences.
- c. Sentences can be summarized by a sequence of concepts.
- d. Concepts can be represented by symbols.
- e. Logical organization of sentences can further increase communication speed.

Although the concept of Minspeak is more difficult to understand and may require a greater time investment to implement, Minspeak appears to offer performance well beyond its "level and location" based predecessors. Microcomputer technology has permitted the linguist's proposal to become reality. Without that technology, it would only be an idea.

The last area within the topic of communication is that of outputs. Typical communication aid outputs include:

- a) Correctable display
- b) Printer
- c) Speech
- d) Data

The combination of these appropriate for a particular user will be a function of the expected needs of that person.

Microcomputers frequently contain hardware features that permit them to be used as communication aids. Indeed, attempts have been made to develop programs that make particular units useful as such. However, there has been no widespread success in this area. The issues that must be considered in such a venture are complex. People who know microcomputers generally don't appreciate the complexity of the issues relating to physical, psychological and linguistic capabilities and needs of the users. Further, the process of disseminating software and providing the education and support that is needed can be difficult. Also, the volatility of the microcomputer market has discouraged software developers from making investments in this area. The recent withdrawal from the market by Texas Instruments and Timex are prime examples.

If a microcomputer were to be successfully programmed for use as a communication aid, the cost of a complete system to the user would still be substantially higher than common for mass market items using the same microcomputer. The reason is that very little of the cost of a communication aid is the cost of producing the hardware. The majority is the cost of development and the provision of services.

Frequently, microcomputer enthusiasts will develop a system for a particular user. While this approach does provide something for someone who had nothing, it almost always results in a system that is less effective than the best possible. Consequently, the level of achievement of the user will be limited. In addition, new ideas and techniques are continually being developed. When commercially available systems are used, the development of updates is practical and older units can be improved. Routine service is another issue. Extreme care must be taken to consider the potential result of this approach.

Computer Access

The information revolution is under way. The tool of the information age is the computer. Today the microcomputer is used in a wide variety of applications. Many tasks that used to be performed manually are now much more effectively accomplished using computers. Many jobs are being created around the need to access, process and communicate information. For people with physical handicaps, this situation opens up many opportunities and offers new levels of personal achievement. However, if those people are unable to use computers, not only will they be deprived of those opportunities and achievement, they will be taking a relative step backward in our society.

For example, the microcomputer is now common in the public school classroom. Able-bodied students use it as part of their normal education. if the disabled student is unable to use it, he is deprived of this new educational opportunity available to the rest of the students.

Perhaps the most common productive application of the microcomputer is a word processing system. This function is useful in educational, vocational and personal activities. It may be more valuable to people with severe physical handicaps than to able-bodied persons as the disabled often don't have the alternative of writing or typing.

Computer access can be accomplished in different ways. Of course, the ideal situation is the use of a standard keyboard. Sometimes the use of a mouthstick or head mounted pointer permits this. For those unable to operate the standard keyboard, alternatives must be sought. One of the easiest approaches is the addition of a keyguard to the keyboard. A keyguard consists of a flat surface mounted over the keyboard to support the hand. This permits the person with cerebral palsy to stabilize the hand. A hole over each key permits the keys to be activated. For keys that must be pressed in combination with another key, such as SHIFT and CONTROL, latching mechanisms can be included that will hold them down. This feature is needed for a person who can use only a single finger, mouth stick or headpointer. To enter a CONTROL "S", for example, the user would first press CONTROL, then "S", then release the CONTROL key. For people who are unable to operate even a guarded keyboard, other alternatives must be sought. Sometimes a control interface can be connected directly to the computer, perhaps through the game paddle ports or in parallel with one of the keys. The program can then be modified or a special program can be written to monitor the status of the control interface. Generally, the modification of standard software or the development of custom software to duplicate the function of standard software has serious faults. The main problem is that the investment is only useful for that one program and the process must be duplicated for each new program. Also, the overall performance will almost always be less than the best possible. A far better approach is to modify the hardware to permit access by the disabled person. Most software is written under the assumption that the user will enter information through the computer keyboard. Therefore, a generic solution to the problem is to provide the disabled person with a means of entering information into the computer in a manner that lets the computer think the information is coming from the keyboard. Hardware is available for several microcomputers that will permit this. The device is called a keyboard emulator.

Keyboard emulators are typically connected between the keyboard and the central processing unit (CPU). They accept ASCII (American Standard Code for Information Interchange) characters from an external device and enter them into the computer as if they are keystrokes on the keyboard. Normally the keyboard remains active. Therefore, in a classroom the computer can be used both by able-bodied and disabled students.

At this point, the issue is one of providing disabled persons with a means of generating ASCII characters. Several alternatives exist. An expressive communication aid may be able to provide the characters.

The communication aid, which should be a portable battery powered device, is often mounted on the user's wheelchair. It can be connected to the keyboard emulator using a cable. However, a wireless telemetry system would provide a cleaner environment. If the user operates a powered wheelchair, wireless data telemetry permits independent mobility.

For the person without a communication aid with data output, other alternatives are available. A person with high spinal cord injury normally would not need a communication aid. One approach for that person could be blowing and sucking on a tube to enter dots and dashes in Morse code for the ASCII convertor. Two switch input using an Apple computer has been developed at Northwestern University. Another approach could be the use of head movement to make selections on a keyboard matrix.

A microcomputer with an appropriate program could be dedicated to the function of an ASCII generator. The program running on this computer would monitor a control interface operated by the user and would respond with ASCII characters or strings.

Environmental Control

After communication and computer access, the next need of a person with a severe physical disability is the operating of various electrical devices in his surroundings. Typical environmental control systems can answer and dial the telephone, turn powered devices on and off, dim lamps, position the electric bed, and operate other special accessories such as intercoms, nurse's calls, page turners, television channel selectors, etc.

Today, operations from the premise that everyone needs to be able to operate a computer, the approach to environmental control has changed. Environmental control systems are available that are controlled through ASCII characters. This means that the person who uses a computer or is able to generate ASCII characters now has the power of an environmental control system without the need for any additional physical capability.

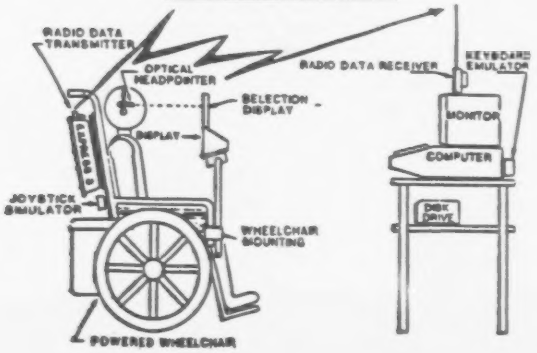
As with communication systems, it is possible to create an environmental control system using a microcomputer, peripheral hardware and an appropriate program. While the performance of an environmental control is not nearly as important as the performance of a communication aid or computer access system, there are still some issues that should be considered. One is operation during a power failure. When power fails, most accessories will not be functional because of their dependence on electricity. However, a function that may be quite important, particularly for a person with severe physical disability, is the telephone. If the environmental control is based around a "mains" powered microcomputer, then nothing else will function when power fails. Commercial environmental controls generally offer a standard or optional battery backup to keep the telephone function intact.

Integrating Communication, Computer Access and Environmental Control with Mobility

Much work has been addressed to the separate areas of communication, computer access, environmental control and mobility. The first three of these areas inherently integrate. However, little has been done to integrate these with the area of mobility. For people with less severe levels of impairment, integration is not necessary. These people have enough physical capability to be able to use the conventional solutions to the separate problems. But people with limited capabilities may only be able to use one technical aid. For example, since a person's potential for achievement is closely tied to the ability to communicate, it makes sense to use the total physical capability toward that end. Without integration, no capability may be left for the control of other aids. If the control of the technical aids addressing all areas of need can be integrated, then the same capability can be used in all areas.

Based on work completed by the Rehabilitation Engineering Center at the University of Tennessee in Memphis, Prentke Romich Company is pursuing this area. PRC is presently under contract with the United States Department of Education to assemble, evaluate and develop a marketing plan for such a system.

THE LAINEY SYSTEM



The Lainey System, named after a prototype user, primarily uses commercially available components. Additional components are soon expected to become commercially available. The first system demonstrated uses an optical headpointer as the control interface and is based around the PRC Express 3 or Minspeak. A standard wireless data telemetry system and keyboard emulator provide computer access.

Powered wheelchair control is provided by a joystick simulator. The original powered wheelchair electronic control package is retained. The rationale for this has facets. First, the powered wheelchair manufacturer knows the power and control requirements of the wheelchair and motors and, therefore, should be able to develop a more reliable and effective system. Second, when a failure does occur, the local dealer is in a much better position to quickly service the system as replacement parts are more likely to be stocked locally.

Computer access is provided by a wireless data telemtry system. The transmitter is connected to the Express 3 or Minspeak and the receiver is connected to the computer keyboard emulator.

Environmental control, while not a priority of classroom students, is important at home. Using an environmental control system that can accept ASCII characters, that function is available to the user without any additional physical capability requirement. Using the wireless telemetry, for example, the user in his living room could transmit a code to the environmental control in the bedroom which in turn transmits over the power line to the power control module, turning the stereo beside him on.

At the time of this writing, Prentke Romich Company plans to make this entire system available.

Summary and Challenge

Even with all of this exciting

technological progress, new problems are being created. Now that functional technical aids are available, we must address the task of getting them to the people for whom they have been created. First, is awareness building. People who need, or who have clients who need, technical aids must become familiar with the capabilities that these systems offer. Those rehabilitation professionals who select and apply technical aid systems must then learn how to do so in a manner that best serves the interests of the client. Finally, funding for technical aids and the necessary corresponding services must be provided. In all of these areas we are making progress, but more work is needed.

For people with severe physical disabilities there has never been a better time in history. As never before, these people can be active and productive members of our society. With technical aids in the areas of communication, computer access, environmental control and mobility, people can set and achieve goals in educational, vocational and personal pursuits.

THE POTENTIAL OF ARTIFICIAL INTELLIGENCE IN AIDS FOR THE DISABLED

JOHN J. BOYER

ABSTRACT

This paper explores the possibilities for applying the knowledge of Artificial Intelligence research to aids for the disabled. Though many computerized aids have been developed, some of them quite sophisticated, very few of them have been "intelligent" in the sense that they make use of knowledge. Because Artificial Intelligence is still a rather unfamiliar field, this paper begins with a definition of this branch of computer science. By way of background the areas of basic AI research are then surveyed. The areas of applied research most relevant to the development of aids for the disabled are then discussed. Because disabled persons typically have "input" and "output" problems, the provision of a good linkage between human and computer is then explored, with emphasis on direct connection to the nervous system. Finally, some areas of applied research special to disabled persons are examined.

This paper concludes with suggested guidelines for determining if an aid is "intelligent".

This paper is a satellite's-eye view of an almost unexplored part of the computer usage world. A preliminary library search turned up no papers with the keywords "disabled" and "artificial intelligence." However, the territory which must be surveyed to comprehend how artificial intelligence techniques can be used to help the disabled is very large. So my survey must be very brief indeed. Research in this field is continuing at Computers to Help People, Inc.

What is Artificial Intelligence

1.1 Definition

Artificial Intelligence is the attempt to program digital computers to exhibit certain types of behavior and perceptual abilities which can be regarded as "intelligent" if exhibited by a human being. These behaviors and abilities are spelled out in Section 2, which describes areas of basic AI research.

1.2 Boundaries

Lower Limit: Artificial Intelligence does not include numerical problems such as statistical analysis or the simulation of physical phenomena, nor does it include record-keeping functions or data processing. Upper Limit: At present this is undefinable. It is probably set by the amount of computation that can be performed between the occurrence of an event and the time when a response to it must be made.

Areas of Basic AI Research

2.1 Computer Vision

This perceptual ability would enable a computer to examine a scene with TV cameras and respond to it in much the same way as a person. At present, industrial robots guided by vision can perform some simple tasks; computers which can produce a fairly good description of a single image are operating in laboratories, but these computers require 20 minutes to analyze an image. More powerful microcomputers will, in the near future, make it possible to build vision systems that can be used on the street and in the home.

2.2 Understanding Written Language

Such a perceptual ability would enable a robot to accept commands typed in ordinary English, or it would enable the computer to answer questions posed by people who are not computer literate. Question-answer programs of this type are now commercially viable. Work is also proceeding on machine translation of one language into another.

2.3 Understanding Spoken Language

This is another perceptual ability which would make computers more accessible to noncomputer literate people. Considerable progress has been made in the recognition of words carefully spoken by a single speaker, with a pause between words. Understanding normal speech, however, is a formidable task, requiring information from disciplines as diverse as acoustics and linguistics. Laboratory machines can perform this feat with a limited vocabulary, but they are much too large and expensive for general use.

2.4 Modeling Human Mental Processes

Basically, this is an attempt to learn more about the only "intelligent machine" we know, the human brain. It is accomplished by formulating theories of human mental processes such as memory, problem solving, and belief formation, and then applying these theories to produce human-like responses when expressed by computer programs. This work has contributed many ideas about how intelligent computers might be built. The work has also made important contributions to psychology.

2.5 Machine Learning

The ability to learn seems more fundamental than both perception and behavior to any intelligent entity. It is one of the most difficult abilities to program into a computer. We want more than a machine which just passively accepts the data that are fed to it. We want a machine which can take advice and learn from experience. Some progress has been made in advice-taking machines and in programs which learn from carefully chosen examples, but the general solution remains elusive. True learning seems to require a degree of creativity that is too difficult even to apply to basic research.

2.6 Knowledge Representation

Though neither a behavior nor a perceptual ability, this is another fundamental area of AI research, It is perhaps even more fundamental than learning. The knowledge that the machine possesses, whether provided by the programmer or acquired through learning, must be stored in a limited memory so that it is easily and quickly available for use in reasoning and solving problems. Fundamental philosophical questions, such as "what is knowledge?" and "what is meaning?", are also involved. A great many schemes of knowledge representation have been tried. Perhaps the most popular is that of "semantic networks."

2.7 Game Playing

There may be readers who contend that much human game playing scarcely qualifies an intelligent behavior. In this I concur, but in games such as checkers and chess, which have received a great deal of attention in AI, the role of intelligence is undoubted. Early investigation of these games developed many of the principal AI techniques such as heuristic search. Some of the best work on machine learning was produced by Samuel (1963) with the game of checkers. Presently, chess programs can play at the grand master level, though no one expects a computer to become world chess champion any time soon.

2.8 Deduction and Theorem Proving

Many mathematicians and philosophers would like us to believe that this is the quintessential intelligent behavior. Although computers can use deduction to solve simple problems, they have yet to find a significant new mathematical theorem. Perhaps the most important contribution of theorem proving is the introduction of the language of formal logic into AI. This language is one of the most useful ways of representing knowledge and some of the newest AI programming languages are based on it.

2.9 Planning and Problem Solving

To plan is to determine a course of action before taking it. Intelligence is required both to foresee possible future events and to pick a sequence of actions to achieve a goal. Robots especially need the ability to plan, and not surprisingly, much of the planning research has been completed using real or simulated robots. Problem solving is closely related to planning because problem solving requires the discovery of a sequence of moves that will produce a desired configuration.

2.10 AI Programming Languages

Research in this area is concerned not so much with how computers can be made to perceive or behave as with how they can be programmed to do so. Artificial Intelligence programs are very large and complex. The main bottleneck in the wider application of AI may be the difficulty of writing these programs. The earliest special programming language for AI was LISP, developed by John McCarthy at MIT in 1960. Without it, the development of AI would have been much slower. It also contributed fundamental ideas to the broader field of computer science. Even today, LISP is used for writing many AI programs. However, it is being displaced by PROLOG (Clocksin, W. & Mellish, 1981), which is based on the language of formal logic and is more expressive.

2.11 Program-Writing Programs

One indication of intelligence is the ability to find things out for oneself, without having everything spelled out. Since AI programs are so difficult to write, workers in this field are naturally very interested in endowing computers with the ability to write their own programs. This would also give the machine a special form of learning, maybe even the ability to lift themselves by their own bootstraps. Programs have been written which can turn specifications written in stylized English into a complete program; they can also produce programs from examples of the desired program; but alas none of these program-writing programs seem to hold promise of relieving AI researchers of even part of their burden.

2.12 AI Architectures

Perception and intelligent behavior require a material substrate--a brain or, just maybe, a computer. The field of computer design is termed "computer architecture," hence the name of this area of AI research. How does an AI computer differ from an ordinary computer? For one thing, it must be able to do many things at once. For another, it must be good at manipulating symbols instead of manipulating numbers. Perhaps most important, it must have special features that make programs written in AI programming language run as fast as possible. Many such machines have been built or attempted. The Japanese, with their "fifth Generation" computer projects (Feigenbaum, E., & McCorduck, P., 1983), are making a major effort in this area and hope to outpace the united States in what is probably the next computer revolution.

Application Areas Relevant to the Disabled

3.1 Robots

The desire for robots that do more than rivet and spot weld is a primary motivation for the basic research area of planning and problem solving. The area of computer vision has also grown from this desire. In the early 1970's, Winograd (1972) wrote a program that understood English keyboard commands well enough to control a robot pictured on a TV screen. The use of English commands in a practical robot, however, must await developments in machine learning; AI architecture developments are also needed. Robots can obviously be very helpful to the motor-impaired, and can also serve as guides for the blind.

3.2 Intelligent Vehicles

From a computer scientist's point of view, the principal difference between a robot and a vehicle is that the latter must often follow a map. Hence, intelligent vehicles crucially depend upon the basic area of knowledge representation. On the other hand, an intelligent vehicle needs only to be told the destination; this might be accomplished by means of a simple keyboard. The utility of such a machine for the blind hardly needs to be stated. Persons with severe motor impairments would also find it useful.

3.3 Expert Systems

An expert system is a computer program that can answer questions and give advice where human experts are usually required to give a quality answer. The best existing expert program is probably MYCIN (Shortliffe, E.H., 1976) MYCIN can diagnose infections and make therapeutic recommendations with an accuracy equal to that of most physicians. The catch, of course, is that MYCIN knows nothing about any other kind of disease, nor does it have any bedside manner. Expert systems depend heavily upon knowledge representation. While research is under way to enable expert systems to learn from experience or observation, most of them must simply be fed knowledge by a "knowledge engineer" working with a human expert or group of experts. A possible application of expert systems for the disabled would be the prescription of aids and services. Ophthalmologists, for example, typically know little about low vision aids, and would welcome the chance to consult with an expert, even a computerized one. Expert systems will also be needed as part of intelligent, computer-aided instruction systems.

3.4 Intelligent Computer-aided Instruction

This description means that the program does much more than present lessons on the screen, ask for answers, and select the next lesson based on the student's responses. Such a program "knows" very little about either the course material or the student. An intelligent CAI system contains a representation of the course knowledge and a reasoning facility that makes it an expert problem solver and problem generator in the subject matter. It can also converse with the student in somewhat the same way as a human teacher. Finally, the program builds a model of the student, so that it can conjecture what his/her misunderstandings are and take remedial action. Many connections to the basic areas of research are implicit in the foregoing description, as is the connection to expert systems. The potential of intelligent CAI programs for the disabled challenges the imagination. To cite just two possibilities, such programs might be used to acquaint blind or deaf children (or even adults) with the worlds of vision and hearing.

3.5 Artificial Intelligence for Microcomputers

Up to the present, most artificial intelligence programs have run on large "mainframe" computers, or at best desk-size minicomputers. If such programs are to be useful on the street, in the home, or the workplace, they must run on machines which are, at worst, desk top size, like most of today's personal computers. Texas Instruments has made a step in the right direction with its NaturalLink (Hassett, J., 1984) program, which enables the user to access the Dow Jones Information Service in English. Other companies are also introducing AI products which run on machines such as the Apple and the IBM PC. The Japanese are working night and day on both machines and programs. More efficient knowledge representations and better AI architectures are the primary needs, but advances in natural language understanding are also needed to make such systems really acceptable.

3.6 Intelligent Information-Retrieval Systems

The NaturalLink program mentioned in the previous section, and the INTELLECT (Hassett, J., 1984) program alluded to in Section 2.2, are examples of such systems. Similar systems could be very helpful for accessing library services, so a handicapped user could simply ask for the information he needs using his own terminal, which would have adaptations he might need, and receive this information in plain English. With advances in AI architectures, it will be possible in the near future to store a considerable library in a space the size of a filing cabinet drawer, and the user will be able to roam at will through this store of information, adding, deleting, and annotating as he chooses--all in English. This will be of great benefit to disabled students, lawyers, engineers, etc.

3.7 User-Friendly Computers

Basically, this is what we've been talking about in the last two sections. But user-friendly computers, computers that the user feels comfortable with which he can operate without reading the manuals, are more than this. They are also computers that can be programmed, perhaps not in ordinary English, but at least in a stylized version of English, that don't have to be told every little detail of the program. They are also computers which learn about their users so that they know what to expect under given circumstances. Like the ICAI systems discussed in Section 3.4, they might build up a model of the user's mental processes and might have some understanding of psychology. (Programs which mimic various types of psychotherapy have already been tried.)

3.8 Making AI Comprehensible to Ordinary Programmers

This is an important issue, because AI has developed in the hothouse atmosphere of academia. If AI techniques are to be widely applied, both the program and the programming languages in which they are expressed must be understandable to more people than computer science masters. Indeed, they are often not comprehensible even to this elite. Much of this abstruseness is due to the use of quasi-mathematical forms of expression and to habits of convoluted thinking. AI programming is not for everyone, but simpler techniques should be with in the reach of most programmers.

The Human-computer Interface

This section is included because disabled persons typically have "input" or "output" problems. In preceding sections, i.e., on user-friendly computers, I have discussed what might be called the "cognitive interface." Discussion of the physical link between human and computer now seems in order.

4.1 The Inadequacy of Present Interfaces

Although the most common human computer interface--the combination of keyboard and TV screen--has obvious disadvantages for persons with either sensory or motor impairments, it is true that with special adaptive devices a disabled person can have a better "linkage" with the world through a computer. At least a limited ability to understand speech, will be a great advance when it comes, but it will not help the nonverbal. Technology is now arriving for another type of interface, as applicable to the disabled as to the nondisabled; it will put everyone on an equal footing.

4.2 Direct Connection to the Nervous System

The statement has been made, and may well be made again, that the computer is the most potent mental tool ever invented. Why not, then, bypass possible inoperative organic sensors and effectors and connect it directly to the nervous system? Computers which are small enough to be implanted inside the body are already available. The chief problem is the provision of power and, of course, the actual interface. Research has been conducted at the University of Utah and elsewhere on the implantation of electrodes in the cochlea, or inner ear. A long series of experiments have been completed by Dobeel (1979) and his colleagues in which electrodes were implanted in the visual cortex of human subjects and stimulated, with encouraging results. It is my feeling, however, that this latter approach is unduly invasive and dangerous. It is better to make the connection to the peripheral nervous system which is more robust than the brain and can regenerate if a mistake is made. At present this can actually be done, though crudely.

4.3 Towards Symbiotic Human-Computer Systems

It is the dream of every disabled person to have free access to all information, and to control as much of the external world as his/her non-disabled counterparts. Computer technology and neurophysiology are progressing to the point that a human being and an intelligent computer can be linked into a truly symbiotic entity in which each member does what he/she/it is best capable of doing. The human has full scope for exercising imagination, intuition, and creativity. The computer has its abilities for fast calculations and for precise logical reasoning. In the case of a sensorially deprived human being, the computer would also provide enough perceptive power that the human could use his adaptive ability to learn to interpret the external world through the artificial senses. A motor-impaired person would be able to control his environment or a vehicle through thought alone. Although this concept of a human-computer team is applicable to everyone, it is quite possible that disabled persons will be among the first to put it into practice.

Special Application Areas for the Disabled

Although the general application areas discussed in Section 3 will be of great advantage to the disabled, there are also a few applications which are unlikely to be taken up in any other content. These are discussed in this section.

5.1 Perceptual Aids

Two principal types of aids for the sensorially-deprived are likely to be developed; visual guidance systems for the blind and phonetic transcription systems for the deaf. The former would guide a blind or deaf-blind user safely through an urban environment, perhaps even enable him to drive a car. Formidable problems in "scene analysis" must still be overcome, but one of the greatest difficulties is conveying the perceptual information through auditory and tactile channels of limited capacity. A perceptual aid of this type is now under development at the Smith-Kettlewell Eye Research Institute in San Francisco. I am working on such a device, but taking a different approach.

A phonetic transcription aid for the deaf would monitor a conversation and produce a phonetically-spelled transcript of it in a written form, perhaps on a video monitor (TV screen), or in Braille for deaf-blind users. It would also be capable of identifying various speakers for its user. Such a device might be relatively easy to build, yet the complexities of spoken language requires some understanding of the subject matter to make an intelligible transcript. Greater advances in the understanding of spoken language are, therefore, needed before it can become viable.

5.2 Intelligent Environment-Control Systems

The term "intelligent" means here that the environmental control system will respond to commands in normal speech and not just the isolated words that most current systems can handle. It will learn about the needs and desires of its user, so that it will be capable of adjusting the environment without explicit directions.

5.3 Intelligent Wheelchairs

An intelligent wheelchair imposes more stringent requirements than your ordinary, run-of-the-mill intelligent vehicle, because of its small size and peculiar operating environment. It should be adaptive, learning how to adjust to its user; it will respond to spoken commands and it may incorporate an environmental-control center. It might also contain perceptual aids and effectors, as well as information-processing facilities such as an intelligent word processor.

5.4 Helper Robots

The intelligent wheelchair discussed above is practically a robot with a human user providing the majority of the control and decision-making functions. Helper robots capable of independent operation will become feasible before the general problems of robotics are solved, just as industrial robots are feasible now. Experimental machines are already in existence. A robot arm developed at John Hopkins has been helping quadriplegics feed themselves and do office work for a number of years. A guide dog robot developed in Japan has successfully guided blind users along paths marked out with special "landmarks." These devices, however, are quite unintelligent, as they lack learning ability and do not respond to natural language commands.

Conclusions

Based on the above, I would like to propose the following guidelines for determining whether an aid is "intelligent." A device may deserve this adjective if it satisfies one of these guidelines to a high degree, or several of them to some degree.

1. Does it have some perceptual ability, i.e., can it analyze a scene or understand human language?
2. Does it have an internal model of its user, so that it can guess his/her state of mind?
3. Does it learn?
4. Can it reason logically, drawing conclusions from premises?
5. Can it make plans?
6. Is it self-programming?

Acknowledgements:

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THE CONNECTICUT SPECIAL EDUCATION NETWORK FOR SOFTWARE EVALUATION (ConnSENSE)

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ABSTRACT

This presentation overviews the activities of the Connecticut Special Education Network for Software Evaluation (ConnSENSE). The overall goal of this project is to develop and field test a statewide model that evaluates the effectiveness of special education microcomputer software and to disseminate the results within Connecticut and beyond. To insure that this goal is achieved, we have developed a software evaluation model and instrument, conducted a software needs assessment, trained teachers and administrators to evaluate software, evaluated microcomputer software, developed a dissemination model to be used by the Connecticut state Department of Education, and developed a special education microcomputer users group. We believe that these activities are helping special education teachers and administrators throughout Connecticut to select more effective microcomputer software and thereby to deliver a higher quality instruction to handicapped children.

During the past week, IBM rocked the computer industry by announcing a new family of integrated software designed to challenge the ever-expanding set of highly successful but smaller software companies (Rasie, 1984). Given current software sales of about $2.7 billion and projected sales of $23.5 billion by 1989, this move into the software business arena might have been anticipated. But the issue of access to quality software designed for educational applications remains. In fact, many analysts and experts, including Terrel Bell, U.S. Secretary of Education, have argued that this is precisely the issue that will determine whether microcomputers can have their much heralded long-term educational impact (Bell, 1984).

The Connecticut Special Education Network for Software Evaluation (ConnSENSE) was funded by the Connecticut State Department of Education, Bureau of Student Services, as a vehicle for insuring that special educators throughout the state have access to information on "software that works." During the past year this project began the long and arduous process of software evaluation and information dissemination. Below is an overview of the project, the procedures which we used for software evaluation and dissemination, and our achievements to date.

Project Design

General Design

The overall goal of Connecticut's Special Education Network for Software

Evaluation (ConnSENSE) has been to develop and field test a statewide model to evaluate the effectiveness of special education microcomputer software and to disseminate the results on a statewide basis. To achieve this overall goal the project has developed a software evaluation model and instrument, conducted a software needs assessment, training teachers and administrators to evaluate software, evaluated microcomputer software, developed a dissemination model that can be used by the Connecticut State Department of Education, and developed a special education microcomputer users group. Details on these activities follow.

Special Education Software Evaluation Instrument

Several approaches have been proposed for the evaluation of educational software. However, only a few have been developed with the specific needs of the handicapped in mind. Consequently, ConnSENSE's first major activity was to develop a model and instrument for the evaluation of special education software. The ConnSENSE Courseware Evaluation Form that emerged relies on previous work in the general area of software evaluation (e.g. Micrpark, EPIE, MCE Inc., etc.), while being sensitive to the specific needs of handicapped children.

Consistent with much of the literature on evaluation in general and software evaluation in particular, our instrument calls for both descriptive and evaluative information. Descriptive information includes general concerns (e.g., title, author, publisher, etc.), hardware concerns (e.g., memory requirements, disk and printer requirements, need for speech synthesizer, etc.), publisher support policies (e.g., preview, backup, and guarantee), publisher claims concerning suitability for specific handicapping conditions, and general program goals and objectives.

Evaluative information is provided on a five-point Likert Scale for specific items relating to the general categories of Program Documentation (e.g., availability of supplementary teacher and student material, operating instructions, etc.), educational validity (e.g., content accuracy, adherence to accepted learning/teaching practices, relationship between content and objectives, etc.), Presentation/Instructional Quality (e.g., suitability of screen displays, use of branching and feedback, availability of help screens, etc.), and Technical Qualities (e.g., reliability, ease of use for designated population, etc.). In addition to ratings for individual items, an overall rating is also provided for each of the general categories. Evaluators are also given the opportunity to comment on strengths and weaknesses. A four-point Likert Scale (4=excellent, 3=good, 2=fair, 1=poor) is used for the overall rating.

Although we feel that this information is important for an overall evaluation of educational courseware, much of what has been described can be found in instruments designed for the evaluation of software produced for the general population of students. However, it is "special education courseware" which is the major concern of this project. Thus, based in part on work by Rucker and Vautour (1978), we have included two other general sections on our instrument. The first concerns the level of skill required for the student to use the software. The second concerns the extent to which the software can be modified so that it might be used by children with various handicapping conditions. With information in the first of these areas, a special education teacher will be able to decide whether the courseware matches the skill level of a particular student, regardless of whether the courseware was developed for handicapped children. With information in the second area this same teacher will be able to decide whether courseware that doesn't fit a particular skill level can be modified for a particular student. It is these two areas in the ConnSENSE Courseware Evaluation Form that are unique to the needs of handicapped students.

Looking first at the skills category, we ask evaluators to provide information on the software's reading level and interest level. A continuum of manual dexterity is provided ranging from the used of paddles to touch typing. To accommodate the visually handicapped, a continuum of text size is included. Some of the other skill areas include color discrimination, speech (for voice activated programs), hearing level, eye-hand coordination, and sequential memory requirements.

Rucker and Vautour (1978) proposed a rationale for modifying IEPs for handicapped children that has utility in terms of modifying courseware for handicapped children. These modifications fall into the four areas of presentation, performance, content, and time. Presentation modifications in the instrument include print size, use of a speech synthesizer, and graphics. Performance modifications address ways a student displays mastery of a specific skill or concept. Examples in the instrument include input via voice, switches, light pen, etc. Examples of content modifications are programs that allow the teacher to input spelling words or letters for a letter recognition exercise. Two additional items that don't quite fit these categories, but are nontheless important, have also been included in the evaluation instrument. These are the kind of feedback presented (e.g., sound, graphics, and animation), and the type of reinforcement schedule utilized (e.g., consistent or random). The last part of our instrument provides evaluators with an opportunity to give an overall assessment of the courseware and to offer some summarized comments on the courseware's strengths and weaknesses. It displays a rating for each of the four major evaluation areas plus an overall "grade." There are also comments on the skill level required and any modifications possible. Finally, there are summary statements on the suitability of the courseware with particular groups of children.

The ConnSENSE Courseware Evaluation Form was reviewed by various content experts in special education and modified, based on their comments. The form was then field tested at the University of Connecticut with the first cadre of software evaluators in March of 1984. Further modifications were made after this session. The second cadre of evaluators (May, 1984) contributed additional modifications that resulted in the present form of the instrument. Software used by special educators can be categorized into either management software (e.g., IEP development, record keeping, etc.) or courseware. Further, within the latter grouping is material designed for most children for "regular" education and material that publishers claim is specifically designed for handicapped children or can be modified for them. Although the ConnSENSE Courseware Evaluation Instrument was designed with this latter type of software in mind, it can be used to evaluate either type of courseware. However, the instrument is not suited to the evaluation of management software. The SECTOR project at Utah State University has developed an instrument for this purpose.

Evaluate Connecticut Special Education Microcomputer Software Needs

ConnSENSE completed a Connecticut special education microcomputer software needs assessment in October of 1983. Some of the results of that survey are:

1. Eighty-seven percent of the school districts had one or more computers available for special education students.
2. Seventy-six percent had Apples (range 1-157), 39 percent had Radio Shacks, and 26 percent had Commodores. Three percent had Ataris or Texas Instruments,

and we only found one IBM being used for instruction with handicapped students.

3. Special education students usually gained access to microcomputers in a special class or resource room (79 percent), but they also used them in regular classes (57 percent) and computer rooms (53 percent).
4. Over half of the respondents indicated a severe need for high quality courseware for children with learning disabilities.
5. Microcomputers were being used most for computer instruction (63 percent) and word processing (43 percent).
6. Areas of future need focus primarily on administrative uses of microcomputers, such as record keeping and IEP development.

Select and Train a Cadre of Special Education Evaluators

The Connecticut Special Education Resource Center (SERC) announced the project in a special October 1983 mailing. This described the project and solicited special education teachers and administrators actively using microcomputers who wanted to be trained in using our software evaluation instrument. A similar request for volunteers was included in the first project Newsletter. We planned to select a cadre of about 20 people to train from those that responded.

Over 300 people responded to the first mailing, however, and 75 percent of them indicated that they wanted training in software evaluation. Moreover, this number grew to over 500 after publication of our Newsletter. Although the project did not plan to train more than 20 teachers, we ended up training two groups of 14. In addition, as will be discussed below, we made arrangements with Connecticut State Department of Education so that the needs of those still interested could be addressed.

The training involves a thorough description of the instrument, trial use of the instrument to evaluate a particular piece of software, and comparisons of responses on the evaluation instrument to this software. After this the cadre began evaluating other pieces of software from the project collection.

Obtain and Evaluate Special Education Microcomputer Software

Project staff wrote to software producers to request their cooperation in our evaluation effort. The initial list of companies was drawn from the LINC Resources list. Response to this first request was slow, probably because we wrote to companies without having the names of appropriate company officials. Nonetheless, we got the impression that some companies were reluctant to provide free copies of software for review. Thus, we decided to purchase our software. This solves the problem of supply and also resolves any conflicts that might result from receiving free software.

As the software began arriving, the project staff reviewed it to determine whether it was (a) relevant to special education instruction or management, (b) in an area that fits established Connecticut special education microcomputer needs, and (c) free of major technical errors. Software which meets these criteria is evaluated by at least four of our cadre of special education software evaluators having the particular expertise required. Their reports are assembled into an overall evaluation review by the project staff, and this review will appear in the next issue of the ConnSENSE Bulletin.

Dissemination Model

The project has assisted the Connecticut State Department of Education in the development of a model for disseminating the results of software evaluations across the state. The

ConnSENSE Bulletin, mentioned earlier, is the major component of the dissemination model. The first mailing of the newsletter (January, 1984) was sent to (a) all special education administrators and supervisors throughout the state, (b) others who may have attended the first Connecticut Microcomputer Conference on Special Education (10/82), and (c) those who responded to the announcements in various publications. Our aim was to disseminate the Newsletter to all special education administrators, supervisors, teachers, pupil personnel workers, and others, including parents, interested in special education microcomputer software.

Three issues of the ConnSENSE Bulletin were published during the 1983-84 year. The content of the first has been described above. The second Newsletter went out in April and described the results of the needs assessment questionnaire and provided insights on special education hardware and software usage in Connecticut. It also included comments received regarding the more popular special education software. This issue contained our first set of five courseware reviews. The newsletter also contained statewide highlights regarding computer usage with handicapped students, a question and answer section, and a calendar of computer events. In this and the following newsletter, the readers were encouraged to consider attempting in-depth field studies in their school district. Finally, the readers were encouraged to join SpecialNet so we could expand our computer network. A third issue published in August contained similar information as well as 15 additional courseware reviews.

ConnSENSE constitutes a users group of people interested in computers and the needs of handicapped students. Our membership is over 900 at this point. The project supported an annual ConnSENSE meeting at the University of Connecticut in July of 1984. Nearly 200 members attended a day of workshops and presentation highlighted by a keynote presentation on the DLM Arcademics Software by Jerry Chaffin and Barbara Thompson.

First Year Reflections

In reviewing our first year of operation, we feel we have accomplished a great deal. We have an instrument that is providing useful information for software reviews. We have completed a statewide needs assessment on computer use with handicapped students. We have trained in excess of 30 teachers and educators in software evaluation. Have evaluated more than 20 pieces of software and published the reviews statewide. Our Bulletin seems to be popular and useful. We have a very large group of special educators interested in computers and the needs of handicapped learners. This group has held its first meeting, and the future looks good for continued exchanges of ideas.

The future looks bright for ConnSENSE. The State Department of Education, through SERC, will fund at least six one day software evaluation workshops at regional locations as in the Fall of 1984. These should include at least 240 special education teachers and administrators. We will attempt to pick the most promising evaluators from these workshops to return for another day of evaluations. We hope to evaluate at least 50 more pieces of software and publish these evaluations in three issues of the ConnSENSE Bulletin.

During the first phase of the ConnSENSE project we had hoped to conduct a feasibility study of computer networking within Connecticut. Fortunately, the State Department of Education issued a Request for Proposals on this subject, and, as a result, we will be moving in this area. A new project, ConnNET, has been funded by the Connecticut State Department of Education, Bureau of Student Services, and will be housed at the University of Connecticut Special Education Center. Its activities will include: initiating Connecticut bulletin board on SpecialNet, developing and disseminating a Connecticut SpecialNet, evaluating telecommunications equipment needs of Connecticut school districts, selecting 30 school districts for SpecialNet subscriptions and training, training local school district and State Department staff in SpecialNet use, and developing a technical assistance plan for the state to use in continuing ConnNet activities.

These activities, combined with those begun during the past year, will allow us to take another step toward improving computer education services within our state. Moreover, by collaborating with other states also engaged in software evaluation and telecommunication activities (e.g., Florida, Utah, and Kansas) we may be able collectively to make strides that none of us could make alone.

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AN IMPROVED ROW/COLUMN SCANNING SYSTEM

LAWRENCE H. WEISS

ABSTRACT

Row/Column scanning is an efficient technique for any technology requiring spelling by nonspeaking persons. Several computer access devices have been developed using this single switch user system. In this paper, the essentials of row/column scanning devices are outlined. The advantages and disadvantages of the use of these devices by persons with disabilities are examined.

Introduction to Row/Column Scanning

Row/Column Scanning is a fairly rapid and very powerful technique for accessing a large number of selections with a single volitional action.

The user must have very good visual tracking skills and not be susceptible to uncontrolled reflex action caused by the strobing lights.

The individuals that have the most to gain by the use of Row/Column Scanning devices are those with only one volitional action (like ALS victims) or those who, although they have pointing skills, need access to devices at all times without expending excess energy (like some with Cerebral Palsy). These "single switch users" have nothing without some type of scanning access technique. Whatever is gained is significant, namely an infinite increase in capability. Any gain after that is gravy.

The variety of needs of the single switch user include communication, mobility, and environmental control. They need these for education, employment, acts of daily living, and a little dignity for an existence where it's generally denied.

There is no doubt that systems could be accessed more quickly by direct means such as pointing (with body parts, body held or worn tools like mouth sticks, eye gaze, remote pointers like light beams, etc.), or by an encoded direct means such as Morse Code. But usually, these tasks cannot be performed except under specific circumstances.

We must always keep in mind that although scanning techniques are relatively slow, they are consistent and effective. A user will never be a conversationalist at 200 plus words a minute, but may become an effective communicator at 6 plus words a minute.

Essentials for Row/Column Scanning

There are some essentials for effective use of a Row/Column Scan device:

1. The device must be designed with an understanding of the criteria of Row/Column Scanning: i.e, the presentation of the scanning display and the layout of information on the display panel are crucial.
2. The technique for use of such a system needs to be taught to the user from the beginning.

The fundamentals for a proper Row/Column Scanning device were functionally presented in the Tufts Interactive Communicator (TIC) developed by R. A. Foulds et al., in the early 1970's. A number of matrix scanning devices were available before that time and some have emerged since. Few, however, followed the guidelines that were in place in the TIC.

> Qualifier:
>
> The following comments are specifically pointing out shortcomings in alternate systems. There are valid reasons for the systems to be the way they are. This is only an attempt to clarify the design characteristics of efficient Row/Column scanning devices.

The most critical oversight of Row/Column Scanners is the presentation of only one light at a time during the scan of both the rows and the columns. The user's tracking skills to select an item from the matrix becomes limiting.

The second oversight is to present the user with only one row at a time, and to then scan that row. In this case, motor reaction time to the changing visual presentation of information is restrictive.

The third area of concern is the continual changing of the display to apply predictive techniques in an attempt to reduce overall selection time. These procedures detract from the learned experiences of a fixed display while also increasing reaction time as described above.

The severest violation to effective Row/Column Scanning is the display panel layout. There seems to be great hesitation to deviate from the 'norm'. The use of straight alphabet (A, B, C, etc.) and the typewriter (Q, W, E, R, T, etc.) layouts abound. It has been proven over and over again that these layouts are as much as 40% slower than a Frequency of Use layout.

"Well then...," how did the operate?

The entire matrix was always in view. All the lights of each row were presented during Row Scanning (the entire row was illuminated simultaneously). After selection of a row, each light in that row illuminated sequentially until one was selected. The selected light flashed and Row Scanning resumed. The flashing period was a confirmation and correction time wherein the selection was negated if the operating control was actuated.

The alphabet layout was Frequency of Use with most common characters in the upper left corner and numbers neatly grouped for easy reference.

The user would fixate on the character to be selected and NOT ON THE FLASHING LIGHTS. The operating switch would be actuated when the desired character was illuminated during Row Scan and, without looking away from the desired character, the user waited for it to illuminate a second time (during Column Scan) to make the final selection. There was ample time during the confirmation period to locate the next selection.

These characteristics were subsequently plagiarized for use in the

ZYGO model 100 Communication System. Observation of users showed without a doubt that scanning speeds faster than .25 secs/step were possible, even by those with severe athetoid cerebral palsy or advanced A.L.S.

The actual output (in words per minute) wasn't as high as indicated. Although the scan speeds were high, so was the false selection/correction activity. It was difficult for most uses to 'catch' the first rows or first columns after switch actuation. The alternatives were to either wait for the scan to wrap around and catch the row or column on the second pass, or to actuate the switch multiple times to force the scan back to the beginning without making an actual selection.

Another approach to assist the user was to leave the first row and the first column blank; the user couldn't get to them anyhow. This defeats the entire concept of the layout.

Design of a More Efficient Row/Column Scanning Device

The primary considerations, therefore, in designing a Row/Column Scanning 'keyboard' for computer access by profoundly physically handicapped individuals were a way to reduce the effects of missing the early rows and columns and to pay considerable attention to the information layout.

The Scan

After careful observation of a number of Model 100 users it was determined that there appeared to be a reaction time to actuating a control switch to select the early rows and columns. Furthermore, the reaction time seemed to exist with everyone, those who were able bodied with good reaction as well as those who were physically disabled. And, it didn't matter what the scan speeds were; while working at one's best speed those first rows remained elusive.

Also, it seemed that when the scan was in its 'steady state', that is continuously scanning, each individual could catch the desired selection with considerable accuracy.

The reaction time was not to the steady state scan...it was to the change in presentation. When the row was selected, the body needed to react to the new presentation and it wasn't primed to do so. Even more prominent was the change from the flashing confirmation to the top row.

The solution was to provide a "non-linear presentation" (Patent Applied For). The scan, rather than be uniform with the timing of each step the same as the one before, was slowed down after each actuation of the control switch and gradually increased to the preset steady state rate.

If the steady state time per scan is 't', then after an entry strobe the first row of lights would remain lighted for a time greater then 't', like 1.5't'. The next row would remain on shorter time, and so on until the fifth row, were the scan would revert to 't' time per step.

Faster scanning speeds can be used with this technique without the customary missing of the early rows and columns. It is obvious that the selection time for a perfect user would be longer than without the added delays, but for the imperfect average user, overall selection time is greatly improved due to the reduction of the error/correction selections.

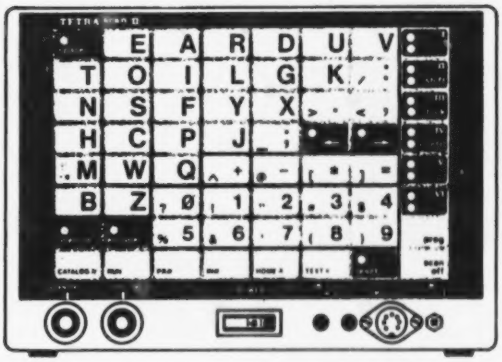
The Display Panel

For purely electronic considerations, the display was restricted to an 8 x 8 matrix. Multi-levels were necessary to accommodate even the barest of selections. The alpha layout was the easiest: stay with the TIC layout. Since selection of levels and operational functions seemed to be less important than the characters, they were delegated to the eighth column, with the fundamental level at the top, in the shortest time to access position.

As in the TIC layout, the numbers were to take a cleanly formatted appearance since they have no Frequency of Use order. Also, for similar reasons, the mathematical functions were neatly grouped adjacent to the numbers.

The Return key was put in the closest space available at the outside of the alpha pattern since it is the most used computer key. The punctuation and the other computer functions filled in the gaps.

Levels I, then, contains lower case characters, primary punctuation, numbers, and math functions. Level II, just as with the computer keyboard, contains upper case characters and the other punctuation and symbols (and a bonus of six function keys in row eight). Level IV is the control level and functions just as on the computer. Levels III, V, and VI (and the six squares in the bottom row of Level I) are user-programmable.



Frequency of Use Research

ZYGO Industries, Inc. has undertaken the development of a program for the APPLE II to determine effectiveness and efficiency of various display panel configurations.

At present, the program allows the introduction and storage of any text and any alpha-numeric pattern (called the "board"). The program will process text with any board and display the number of characters in the text, the number of selections that needed to be made, a normalized time to have scanned the text, and a unit of measure (the normalized time divided by the number of selections) for reference.

The program then provides the quantity in the text of each item on the board to that ranking.

Of the text tried, improvements to the TIC layout remained below 1%.

Future refinements of this program will include the ability to work with multi-levels and include all the functions on the display panel. Although the present program allows the use of blends up to four characters to be in the board, the future versions will allow larger groups and phrases.

Advantages of Row/Column Scanning

1. Consistency. There is an acquired skill in using a Row/Column Scan device much like that of a typist. The location of elements to be selected is always the same and, more importantly, the timing for access is always the same. For example, let's look at spelling the words that contain the letter 'e' in this sentence alone. The 'e' follows 'space', 'l', 'w', 's', 'h', 'b', 'p', 'h' and 'l' again, 't', the 'apostrophe', 's' and 't' again, and then 'n'. If the sentence was being directly selected from a keyboard with one finger there would be the consistency of location, but the motions to get to the 'e' would be all over the keyboard. Realize that with Row/Column Scanning, the time to select each 'e' would be exactly the same regardless of what preceeded it. This speeds up the selection process with improved accuracy as a user gains experience.

2. Positioning Insensitive. Single switch use allows operation from virtually any position, and from varied positions, with similar

ease. For someone with reliable head control it may be practical to use a head actuated switch while sitting in a wheelchair, a different switch while in bed, still another from the therapy mat. Someone with lower extremity capability might use multiple switches that do the same thing (in parallel). They could be arranged for knee action and foot action, in order to reduce the fatigue of using either set of muscles while allowing continued use of the scanning device.

Direct Selection techniques require proper positioning to the device in order to be effective. That severely limits the potential operating time of the majority of users.

3. Exercise. The continued use of a single switch strengthens the associated muscles to where users can continue to function for prolonged periods, not only daily but for extended years.

4. Learning Time. The technique for Row/Column Scanning is straightforward and easily learned in a short time (sometimes it's instantaneous). Others in the user's environment could also interact with the scanning device (i.e., for assistance in arranging programmed messages). The user needs only to have a switch positioned and the scanning device in view in order to operate it.

Disadvantages of Row/Column Scanning

1. Tracking Skills. The user must have tracking skills that are sophisticated enough to follow the scanning lights and actuate an operating control in concert with the lights. Very poor tracking skills that cannot be improved should preclude the use of a Row/Column Scanning device. (A Linear Scanning device might be appropriate).

2. Visual Skills. The user must have eyesight good enough to see the lights as well as the information contained within the auditorily, i.e., a person or device can present rows and columns verbally with selections made by cues from the user. In this case the user's auditory skills and ability to comprehend the auditory cues would apply).

3. Strobing. The strobing lights may cause undesired seizure effects in some individuals. This effect must also be considered for others in the environment of the user. Although the user may not be affected, others who may see the device might be.

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DESIGNING TECHNOLOGY CENTER FOR ILLITERATE ADULTS

TERILYN C. TURNER

ABSTRACT

Illiteracy has been called the "hidden handicap" because adults with literacy problems are adept at camouflaging their disability through years of practice and neccessity. The development of technology and the advent of microcomputers open new possibilities for basic literacy instruction. The design and operational requirements of a technology-assisted basic skills center are described, using an existing center in North Carolina and one being planned in Minnesota as models.

Literacy is a "hot" topic now. To be more specific, illiteracy is a hot topic, which is receiving national attention from the press, the White House, and several large business concerns. To those of us who have been in the literacy field for sometime, the attention is somewhat astonishing. In some ways it is a great relief; I no longer have to explain what I do for a living. People have heard of functional illiteracy, even if they are not entirely clear what it is, or what should be done about it.

The more difficult aspect of this new national consciousness is simplistic solutions to a complex and enigmatic problem. The suggestion that by simply recruiting enough volunteers, the problem will vanish, is a widely promoted myth, particularly by those reluctant to invest capital in literacy efforts. Likewise, a recent "innovative" program designed to train work study students as tutors, was viewed with disdain by many educators who have been implementating that solution for the last five years. In other words, we are seeing old solutions to an old problem.

Adult functional illiteracy is a crucial problem affecting the economic, social, and political vitality of America's communities (Ploetz, 84). An estimated 23 million Americans lack the basic reading and writing skills necessary to function effectively in our society. An additional 30 million are estimated to be marginally able to cope with the demands of daily life (Hunter, 79). The 1980 census affirmed the accuracy of these earlier figures, indicating that 20% of our citizens do not have high school diplomas, and skill level required to function effectively in our society is spiraling upward.

Think, for example, of the secretary trained to use a dictaphone, who now must use a wordprocessor; or think of the auto mechanic who receives manuals and updates on the repair of electronic equipment in our automobiles. The literacy measures move steadily upward, particularly with the advent of technology. Those who once were literate, no longer are literate in our fast-paced, information processing society.

Add to this the stigma attached to illiteracy, and you have a real emotional nightmare. It is a pleasure for me to be in this group, where stigma is understood. Illiteracy has been called the "hidden handicap" because adults with a literacy problem are adept at camouflaging their disability through years of practice and necessity.

Difficulty with reading and math is synonymous with stupidity in our society. The possibility of ridicule, and the fear of disclosure have kept a majority of functional illiterates from "coming out of the closet." It is estimated that all the literacy programs combined are currently reaching 4% of the illiterates needing assistance (Hunter, 79).

Clearly, something other than an old solution is needed to address a problem of this magnitude. What I will suggest as a move in the right direction, is the incorporation of technology into existing literacy programs. While there is a growing use of microcomputers in elementary and high schools, this new technology has yet to be used in adult basic instruction in any substantive way.

Computer-assisted instruction has been used on a limited basis in several experimental programs. By far, the largest amount of research in the field has been conducted on Control Data Corporation's Plato System. Plato's Basic Skills Program was designed by the University of Illinois, the National Science Foundation, and Control Data Corporation (CDC) in 1962. The Plato Basic Skills program has been used extensively in schools throughout the U.S. The data collected by this company and others show remarkable gains in reading and math using the Plato System (Lieberman, 83).

The principal drawback to using a mainframe computer was its expense. The cost of leasing eight CDC terminals for one year was $45,000 in 1979, excluding monthly charges for service and maintenance. The cost of eight terminals could not be justified when two full-time instructors could be hired instead. Other problems included hardware glitches, software design, and the fact that instruction was limited to a fourth grade level and above.

In the last five years, the microcomputer has brought about a revolution in computer usage. These self-contained units allow a flexibility previously not known with the on-line terminals. They are portable and relatively inexpensive. Advances in technology and the advent of microcomputers open new possibilities in the area of basic literacy instruction.

The computer has some striking advantages over other forms of instruction for functional illiterates. Unlike the classroom or even the tutoring situation, the computer is totally private and personal. A computer is infinitely patient, never hurrying or rejecting the learner. Numerous studies have shown the beneficial effect of microcomputers on adult self-concepts and self-esteem (Moyles, 82). Technology provides the opportunity for flexible scheduling, since it is available twenty-four hours a day.

From the standpoint of adult education, probably the most exciting attribute of the microcomputer is its ability to allow the student to control the learning process. Technology empowers the learner. The functional illiterate who has always been dependent on another human being for delivery of instruction, is suddenly placed in control of his own learning. It is truly a revolutionary experience.

The question I raise at this point is, if technology is an appropriate means of instruction for illiterate adults, why aren't there more computers in adult basic skills programs? I think there are two answers: one philosophical, and the other, practical. Meierhenry (82) has indicated that adult education emphasizes goals and objectives that are internally derived. Likewise, Vacc (83) describes the field of adult education as highly humanistic and process-oriented. This is in direct contrast to the behavioral approach found in most software design. The product orientation, competency-based instruction, and sequential skill development of most micro programs leaves adult educators cold.

The second reason that microcomputers are not a major part of adult literacy instruction is their cost. Even though the hardware costs are dropping at an astonishing rate, the investment is still seen as a luxury with little demonstrated value by the majority of adult educators. Historically, adult education has received the least amount of funding in the total educational spectrum. It is not surprising therefore, that technology would receive a lower priority than hiring a teacher.

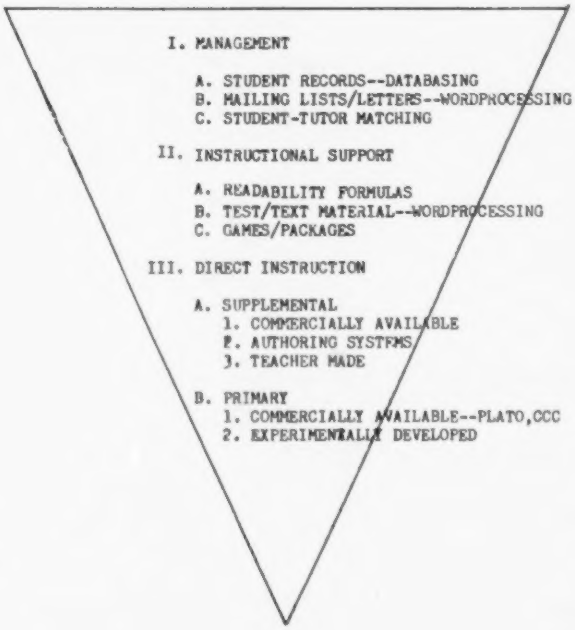
At this point I would like to give an overview, as I see it, of the current use of technology in adult basic skills programs. Since I am assuming that many of you are currently using microcomputers in your programs, I think it is helpful to see where you fit on a continuum, and to find a frame for your experiences.

I am positing a hierarchical ranking of microcomputer usage, based on proximity to the learner. The lowest level, or minimum level, is also the most prevalent, namely, management. Microcomputers are used to maintain student test scores, records, and grades. In the case of literacy councils, they are used to generate letters and mailing lists. Thus, databases and wordprocessing are used quite frequently as management support for existing programs. There has been some attempt in several cities to match students and tutors (volunteers), through zipcode matching. The capability certainly exists, but I am unaware of any literacy program that is actually doing it.

Table 1

Current Use of Microcomputers

in Basic Skills Instruction



I. MANAGEMENT

A. STUDENT RECORDS--DATABASING
B. MAILING LISTS/LETTERS--WORDPROCESSING
C. STUDENT-TUTOR MATCHING

II. INSTRUCTIONAL SUPPORT

A. READABILITY FORMULAS
B. TEST/TEXT MATERIAL--WORDPROCESSING
C. GAMES/PACKAGES

III. DIRECT INSTRUCTION

A. SUPPLEMENTAL
  1. COMMERCIALLY AVAILABLE
  2. AUTHORING SYSTEMS
  3. TEACHER MADE

B. PRIMARY
  1. COMMERCIALLY AVAILABLE--PLATO,CCC
  2. EXPERIMENTALLY DEVELOPED

The second level of microcomputer use is for instructional support. This is the most rapidly growing use of technology for adult basic skill instruction. Adult basic education and literacy programs use readability formulas to determine the reading level of their materials. Unfortunately many of the existing readability programs are more complicated than they need to be, providing abundant useless information.

Wordprocessing is also used by many teachers to generate tests and text material in basic literacy instruction. Games and crossword puzzles requiring the use of a printer, allow instructors to enrich their teaching by supplementing instruction with computer generated materials. One particularly fine example of this was in a language experience class where the instructor was developing a lesson on reading signs. After the board was filled with signs suggested by her students, (ex. stop, yield, railroad crossing), she used a program called, "Crossword Magic" to generate crossword puzzles for each student. The crossword puzzles incorporated the signs as the answers to the puzzle. This supplemental use of the microcomputer for instruction, allows the instructor or teacher to remain in control of the learning experience.

The third level of current microcomputer usage in basic literacy programs is for direct instruction. In the vast majority of cases it is used as supplemental to the primary program. Reading or study skills labs will purchase one or two Apple's, and use them for drill and practice exercises in conjunction with an existing program. Typically, the material is commercially available software. In some cases, an authoring system may be purchased where the teacher is actually called upon to develop the software. Even less frequently, software is developed by teachers at the site. This is usually in response to frustration with locating appropriate software.

The least used application of technology is, in my opinion, the most interesting; that is, the use of the microcomputer as the primary means of instruction. One reason for lack of microcomputer use for primary, direct instruction is the limited number of total curricula developed.

The two principal curricula developed for commercially available basic skills instruction on the microcomputer are: PLATO and CCC. Other programs have been developed and are used experimentally or in limited markets. However, these two dominate the market at the present time. Both have difficulty with the lowest end of the spectrum, adults whose reading level is below fourth grade.

Having described the range of the current state of microcomputers in basic literacy instruction in the nation, I would like to describe a center that is combining all of the different levels in one instructional program. In operation for one year, the ABLE Center in Charlotte, North Carolina, attempts to combine the best features of each of the methodologies used currently in Literacy instruction. The Center uses classroom instruction, tutoring, and the computer. It is unique because the microcomputer is the primary means of instruction. Cablevision, radio, telephone, and the newspaper are instructional media used currently or soon to be added to the ABLE program. The organizational structure includes the use of professionals, clerical, and volunteers. The hardware is a combination of CDC Vikings and Apples, all used as free standing units. Software is a combination of Plato Basic Skills and Apple programs frequently designed for children, but generic enough to be used with adults.

I am presently designing an adult literacy center for St. Paul, Minnesota. I view this new center as one step beyond the ABLE Center. The St. Paul Center will deliver primary instruction to functional illiterates, always pushing technology to its limit in a total and comprehensive educational program. This new Center will have three additional components. It will be designed to train adult educators to incorporate technology into their programs by providing a combination of internships, conferences, and workshops. It will be an experimental model for research to provide desperately needed information on the use of technology with functionally illiterate adults. The Saint Paul Center will also provide incentive grants, to encourage, through matching funds the use of technology for hardware and software acquisitions, by literacy service providers.

In conclusion, I would like to suggest three fruitful areas for expansion and experimentation in the use of microcomputers for functionally illiterate adults. The first is the use of word-processing packages, such as Bankstreet Writer, for teaching reading skills to adults. IBM's Read to Write program is built on this model. There is currently limited experimentation with this use of the microcomputer. Second, use modems to access information for learners. An entire program could be designed around the use of electronic chalkboards and sports information acquired through database access. Finally, I think our greatest hope for breaking the back of illiteracy lies with interactive video.

The military has, by far, completed the most extensive work in this area, and is just now sharing it with basic skill educators. The field of training and development in business and industry has had the funds to develop superb instructional materials. Combining the mesmerizing quality of television with the interactive capability of the computer promises a new way of learning for the functional illiterate (Currier, 83).

We have just begun to explore the technological capabilities of computerized instruction. There is new hope for the illiterate. Centers, such as the ones in North Carolina and Minnesota, may provide new directions for solving the dilemma of functional illiteracy.

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A REDESIGNED PARAPODIUM
NEW HORIZONS FOR THE PARAPLEGIC CHILD

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EDWIN KINNEN

ABSTRACT

This presentation describes a recently completed redesign of the Toronto parapodium and the possibilities the redesign represents for young children with Spina Bifida. A number of previously too difficult daily activities are now possible for young paraplegic children using this new model. The separation of function between the hip and knee joints allows paraplegic children to approach many everyday tasks, such as sitting and standing from a chair, without assistance.

In the past twenty years, medical management for children with myelomeningocele has improved dramatically. During this period, the trend has reversed from most infants with myelomeningocele dying, to a trend of most infants surviving. Shunt procedures, although not without complications, now effectively manage hydracephalus. Also, self-catheterization, urinary diversions, and the artificial sphincter have greatly reduced kidney damage due to reflux. These two medical procedures in addition to early closure of the spinal defect, have contributed greatly to the trend of survival.

The increase in survival in infants with myelomeningocele has also greatly increased the number of children with paraplegia. This increase has now presented a challenge to the habilitation field to develop therapy and orthotic devices which maximize the paraplegic child's potential for independence.

Most orthotic devices designed for paraplegia before 1970, consisted of metal side bars attached to shoes and connected at the hips by a pelvic band, they were then strapped to the legs by means of knee pads, thigh and calf bands. All of these pads and bands were fastened by buckles which made getting in and out of bracing a very time consuming task. Velcro has made fastening straps a much simpler process, however, all of these hip-knee-ankle-foot orthoses, then and now, still required a child with complete paraplegia, reduced skin sensation, and proprioception from joints to hold onto a walker or crutches to remain in standing. Although paraplegic children have been able to walk if strapped into the bracing and given crutches or a walker, they have not been able to remain in standing with their hands free to handle toys once they arrive at their intended destination. Unlike the adult paraplegic, frequently a walker until an accident or illness caused his paraplegia, the child paraplegic has no previous normal experience with balance and standing to recall and use as a resource while using bracing. It is therefore not surprising that most paraplegic children in standard, separate leg bracing exhibit great fear of the standing position.

In 1970, Walter Motloch, designed the only orthotic device to address the paraplegic child's need to have free hands while free standing. This device consisted of an oval shaped foot plate, metal side bars, a pelvic band, knee supports and hip and knee locks. This was the first time that a paraplegic child could stand and play without fear of falling.

Although the original parapodium was a major conceptual breakthrough, therapists and clinics who used the parapodium for a period of years, became aware of functional problems created by the Toronto design. The main problem was that the hip and knee locks of the original design worked together. This meant that the child had to either be fully extended and locked, or fully unlocked and unsupported. This complicated several very important daily tasks. One, the child could not bend over to pick up objects he dropped to the floor during play. If the braces were released at the hip to allow bending, the knee also unlocked leaving the child with no support for standing. Two, the child, trying to sit down or stand up, had to collapse both hip and knee at once to sit, and to stand had to get his body fully extended to lock the joints. Three, the child who wished to be independent going to the floor and standing (as do all young children) had to fall forward fully extend to get to the floor and to return had to have enough arm power to pull his body fully extended to a standing position. Most very young children found these tasks either too frightening or requiring too much arm strength to be a functional everyday activity. For this reason children stood and walked using the parapodium, but did not do a lot of other tasks that could have made them independent.

In 1975, the biomechanics team at the University of Rochester, became involved in changing the lock system so that young children could achieve their maximum potential using the parapodium. The answer seemed to lie with the lock design. Children needed to control their hip and knee joints separately so that they could unlock the hip joint to bend down or to sit in a chair but still leave their knees locked and supported. Because the team focused on young children, it was also necessary for the locks to operate easily with the use of one hand.

Over a period of four years, with the help of two families and their children, the biomechanic team designed a parapodium to fulfill those requirements. The Rochester parapodium (as it is now called) looks very much like the Toronto model until closely examined. The hip and knee joints lock and unlock separately, each pair of joints controlled by a single loop strap. The hip release is placed opposite the child's dominant hand and the knee release is placed in the middle of the knee support for easy access. Also, each pair of joints lock automatically when the joint is in extension.

This system was tested and retested, modified and remodified, until the present model, being made at this time, can be easily operated by a child of 24 - 30 months.

With the separation of the hip and knee joint in operation and with the ease of operation, the paraplegic child using the Rochester parapodium has much more control over his body during daily activities and the ability to stand, hands free. The most important of these daily activities is the ability to change positions - such as getting up and down from the floor, or in and out of a chair; or the ability to bend over at the hip to pick-up objects from the floor.

Sitting and standing with Rochester parapodium can now be done by the child swiveling to a chair, unlocking the hip joint to allow a bend and then sitting while keeping the knees locked and supported. Once the child is seated the knee joints unlocked. This control of joints gives the child much more confidence and security.

The child using the Rochester parapodium may now get to standing from the floor with much less use of strength and energy. Rather than pulling to standing full locked, the child may now unlock the hip joint while prone on the floor, and gradually push-up and walk himself into a jack-knife position - standing on hands and feet then swivel to a chair or walker to pull his upper body fully erect. This process requires much less strength and balance and brings this activity within reach of a 24 - 30 month old.

The other functional activity that has made the biggest difference in the child's daily life is the ability to pick up objects that are dropped to the floor. Previously, a child wearing the toronto parapodium could not drop an object during play and retrieve it because they were unable to unlock the hip joint and keep the knee joints engaged. With the separate locking of hip and knee, of the Rochester model, it is a relatively simple procedure for the child to unlock his hip joint while holding onto a chair or table, bend over, retrieve the lost object, and push back to standing. A small advance, but one of great consequence to the paraplegic child.

These activities give the paraplegic much more security and independence for moving around his home or school with little or no assistance. Many children in braces are still unable to change position from sitting to standing or to lie on the floor, without adult assistance. This is often due to lock systems on many braces today that either require two hands for operation or more strength and coordination than a 24 - 36 month old child usually has.

Approximately 50 children in upstate New York and another 50 around the U.S. and Canada have been fitted with the Rochester Parapodium. Some children fitted in the early stages of the development of the Rochester Parapodium are now six and seven years old. Clinical observation of those children indicates that early age standing, approximately 12 to 15 months of age, has reduced fracture incidence, reduced deformity of leg bones and promoted more normal bone growth. The pelvic portion of the Rochester Parapodium needed to be lengthened because six and seven year old children do not exhibit the shortened trunks typical of Spina Bifida children who have not stood. These children also have developed well proportioned legs. They spent, on the average, 5 to 8 hours per day in their parapodium doing a variety of activities from rolling and crawling on the floor to walking and getting up and down from the floor. Their security in standing has resulted in a positive attitude toward the standing position and more willingness to spend long periods of time in the parapodium. In fact, making adjustments rapidly enough to satisfy both child and parent became a team problem. The children themselves did not want to be out of their brace for more than part of a day.

A pilot study done by the University of Rochester suggested that children wearing the Rochester Parapodium are more outgoing, and initiate more interaction with peers than even children with less paralysis using standard separate-leg bracing. More formal studies are now being done by the University of Rochester and The Ontario Crippled Children Center to document physical, psychological and perceptual-motor skills of children using the Rochester Parapodium in comparison with those of paraplegic children using other devices.

A number of the children trained, as pre-schoolers, in the Rochester Parapodium have made an excellent transition later to other types of bracing, including standard separate-leg braces, and reciprocating braces. Balance and functional abilities, such as getting down or up from the floor and sitting or standing from a chair that were learned in the Rochester Parapodium were retained and transferred to other types of braces with minimal training. In fact, even children with T-12 leisons transferring to standard hip-knee-ankle-foot orthoses and remained community ambulators. Early years of standing seemed to establish in these children a self-concept as a standing, walking person.

Although the Rochester Parapodium is not the best device for all Spina Bifida children, it fulfills a very special need for the child with complete paraplegia. Observation of children using the Rochester Parapodium over a period of six or seven years, leads us to feel that the physical and psychological benefits of early standing with hands free and a period of secure standing and walking during the development of basic mobility skills, is well worth the effort it requires.

For those who wish to explore this device further, contact the Birth Defects Center at the University of Rochester Medical Center, Rochester, New York. A film entitled "All by Myself" is available, which visually portrays the possibilities for the use of the Rochester Parapodium. Additionally, the Rochester Parapodium can be purchased in kit form, to be fitted to the child by an orthotist. Lastly, a training manual is available to assist both parents and professionals in the maximization of the child's use of the Rochester Parapodium.

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THE COMPUTER AS A CROSS OCCUPATIONAL TOOL IN THE VOCATIONAL PREPARATION OF DISABLED PERSONS

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J. EDWARD COTGAGEORGE

ABSTRACT

This research, project #128AH 40008 funded by RSA grant #6008893445, involving 120 deaf and hearing impaired persons, is in the first year of a three year process examining the effects of computer training on subsequent success in achieving vocational goals. The subject population has been divided into two groups: workers in transition, operationally defined as persons participating in academic programs. Methods that will contribute to the acquisition of computer skills, is the initial phase of accomplishing the ultimate project, goals are discussed in this paper. These methods include: Indexing of Occupations, Activities Book Outline, Specialized Computer Software (Name That Industry, Name My Occupation), and Adapted Computer Software. Each method is described in the context of the services of which it is a part. These methods are finally related to the development of a theoretical, cross-disability model of vocational services.

Introduction

Recent technological advances in the workplace are radically altering the tasks assumed by humans. The computer is the prime advance. In addition to production and support activities, the computer has become a workplace tool in varied occupational areas. The worker prepared to use the computer as an adjunct to job tasks will be more able to compete in the job market. Disabled persons are at a significant vocational disadvantage and require dual accommodation in the technological work environment: one accommodation to their physical impairment, and one accommodation to computers and their function. These accommodations dictate a process of interchangeable components dictated by the handicapping conditions targeted. The first phase in developing such a model is the development of the model's methodological basis. This paper subsequently provides a discussion of the model and the methods by which it is being implemented.

Problem Statement

Disabled persons are inadequately prepared to compete in non-service occupational areas because of pervasive use of computers and the lack of preparation of disabled persons in the use of computers. Workers which are "high tech" in nature, such as electronic technicians and more common trade and clerical workers such as secretaries or auto mechanics use technology in their workplaces. Common to all these jobs is the use of the computer as a tool and the need for skilled workers who are able to complete assigned tasks by using a computer.

In order to establish hypotheses, assumptions about the research environment were made. Validation of these assumptions was required prior to the development of the model process.

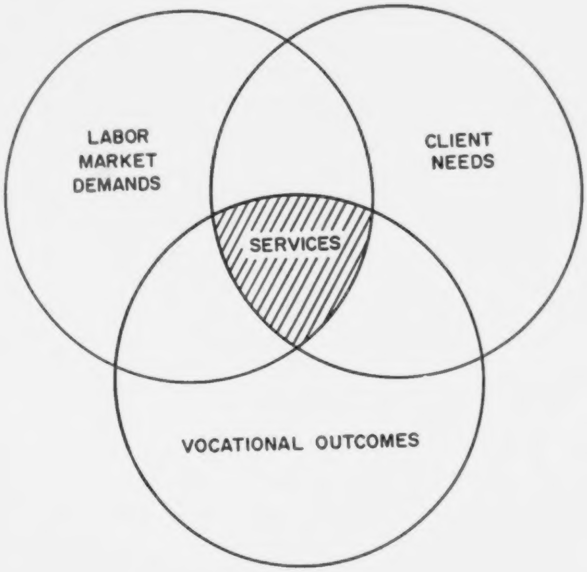
These assumptions were:

1) The computer impact on the employment of disabled persons in various occupational areas is dependent upon:
   a) the relevance of the occupation for the employment opportunities of the target population,
   b) relevance of employment growth in that occupation and,
   c) impact of the computer on the method of performing the job task.

Therefore, it is possible to index the occupational areas according to these criteria and establish a geographic, population specific, occupational cluster.

2) The impact of the computer upon occupational areas will vary by degree and can be rated accordingly.
3) The identified limitations of the target population (in this case deaf and hearing impaired persons) can be over come through an intervention strategy which relates the use of a job specific computer tool to the "deficits of the individual."

This requirement, to test assumptions about the impact of computer technology on occupations across industries, resulted in the need to develop an indexing of occupations. This index is the basis of an interactive model between three "real world" factors and the research/service environment. The indexing is discussed in the methodological portion of this paper. The interactive model can be represented graphically.



The methods to be developed to resolve this problem must be a consequence of the interaction among the demands of the local labor market (e.g., use of computers, skills required, education required, etc.), the needs of the target population (e.g., physical accommodation, academic remediation, etc.), and the anticipated actual vocational outcome. This interaction creates an environment that needs a methodology to address the service needs of the population.

Hypotheses

The previous discussion leads to the following hypotheses. The first relates the project to a longitudinal effort. The second hypotheses is tested in this research phase.

I. A service delivery model which replicates the use of the computer in the workplace will increase participant employability and improve career choice.
II. An instructional model which uses the computer as a tool for providing career and computer information will

improve acquisition of computer literacy skills.

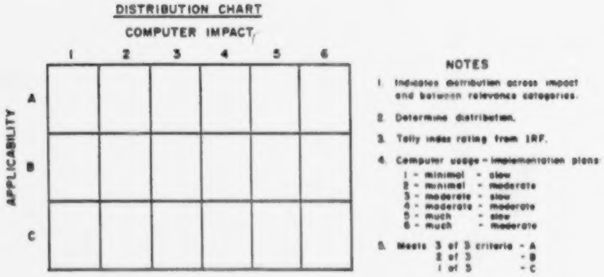
Subjects

The target disability population is deaf and hearing impaired persons. In the subject population, 84% had a profound hearing loss and sixteen percent had a moderate loss. The initial student group of 25 persons was evaluated and 14 persons were selected on the results of vocational evaluation screening and career choice. All participants were involved in a summer work program and used computers in some capacity on the job.

Method/Instrumentation

Following is a discussion of the instruments used in the provision of project services. These instruments are both agency developed systems and modified commercial hardware/software systems.

1. The labor market survey system includes a number of employer contact and questionnaire forms. These range in content from standard job analysis to employer specific information, such as current and projected computer use per occupation, growth forecasts and relevance for employment for the deaf. The combined last three information areas represent the APPLICABILITY factor which will be discussed later. All of this information is compiled into a central INDEX RATING SYSTEM. The Index Rating System supplies information about an employer and the areas of industry, occupational title, employer required training and education, computer usage for the job and applicability for a deaf person. The Index Rating System ultimately assigns an alphanumeric rating to a occupation/job for a particular employer. Computer use is assigned a value from 1 to 6, with 1 representing no use and 6 representing continual use. Applicability is rated A, B, or C depending on the number of information areas that are pertinent to the specific job (see above). An a means that all three areas apply. This system established an ongoing database for all labor market/occupational information for the project.


DISTRIBUTION CHART

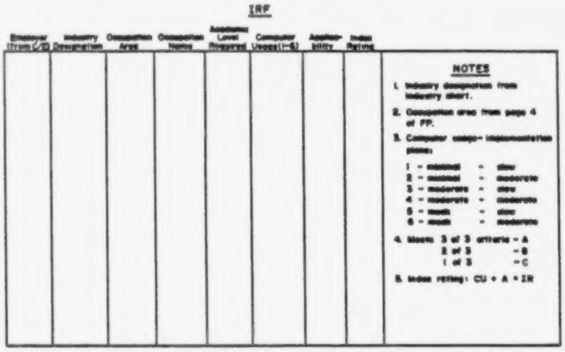
COMPUTER IMPACT

	1	2	3	4	5	6
A						
B						
C						

APPLICABILITY

NOTES

1. Indicates distribution across impact and between relevance categories.
2. Determine distribution.
3. Tally index rating from IRF.
4. Computer usage - implementation plans:
   1 - minimal - slow
   2 - minimal - moderate
   3 - moderate - slow
   4 - moderate - moderate
   5 - much - slow
   6 - much - moderate
5. Meets 3 of 3 criteria - A
   2 of 3 - B
   1 of 3 - C


IRF

Employer (from [illegible])	Industry Designation	Occupation Area	Occupation Name	Academic Level Required	Computer Usage(1-6)	Applicability	Index Rating

NOTES

1. Industry designation from industry chart.
2. Occupation area from page 4 of FP.
3. Computer usage- implementation plans:
   1 - minimal - slow
   2 - minimal - moderate
   3 - moderate - slow
   4 - moderate - moderate
   5 - much - slow
   6 - much - moderate
4. Meets 3 of 3 criteria - A
   2 of 3 - B
   1 of 3 - C
5. Index rating: CU + A = IR

2. ACTIVITIES BOOK OUTLINE (ABO). This instrument is used to provide a structured approach to teaching both computer literacy and career exploration. The book is designed to allow hands-on learning supplemented by discussion and lecture. The ABO is divided into four sections: administration, lesson, projects, and appendix. Each lesson is designed to introduce an introductory concept in both careers and computers. After a discussion of the material the participant performs an exercise with the computer that further demonstrates and reinforces the concepts presented. After three weeks of program involvement, the client begins a project. The project combines newly acquired computer literacy skills and information relevant to their vocational interest area.
3. NAME THAT INDUSTRY (NTI). This is a software instrument developed within COPD. This program reviews, in a highly graphic format, the major local industries. Information about growth projections, percent of the work force, and major occupations within the industry are included. After the information has been reviewed, the program asks a series of questions and requires the user to answer these questions.
4. NAME MY OCCUPATION (NMO). This is another inhouse generated software instrument. This "game" formatted program asks questions about occupations; the computer tries to guess the occupation the participant is thinking about. If the computer guesses incorrectly the participant inputs the correct answer and a question distinguishing their thought about occupation from the incorrect computer guess. The participants teach the computer about occupations and learn themselves.
5. PREVOCATIONAL SCREENING (PVS). In an effort to have better understanding of each client, the PVS is administered to all prospective clients. The areas reviewed are Job Awareness, Interests, Needs, Work Habits, Daily Living Skills and Skills and Abilities. This is not intended as a comprehensive vocational evaluation. The VALPAR Micro--Computer Evaluation and Screening Assessment (MESA) is the primary diagnostics tool. It is coupled with a participant interview to get an idea of preliminary barriers that need attention before a training or employment track is taken. A further component is the VALSEARCH Job Bank. This is a database that provides the participant and the counselor a fast review of 13,000 listings from the Dictionary of Occupational Titles. A client's current vocational and educational functioning, determined by MESA, is compared to similar areas outlined by the Department of Labor Handbook for Analyzing Jobs.
6. SOFTWARE. The computer software used for training includes a list manager, a word processor, and the LOGO language. Adaptations and specific procedures have been made to introduce the basic concepts of each of these instruments to the participants.

The pretest-posttest control group design is used for this project. The t-test for independent samples is used as the statistical analysis of the project. This will provide a means to compare gain scores as a way to determine the effects of participation.

Treatment

Each student received a basic eight week program. Options for an introduction to the computer in technical, clerical, machine and general industrial areas were provided in the program. The project attempted to provide information about each area. This information combined both Dictionary of Occupational Titles and Occupational Outlook Handbook information and the locally generated Index Rating information. Pretesting provided the basal level of career and computer understanding during the last two meetings, participants presented their projects to the group. The type of information presented varied across groups. For example, the clerical group focused on word processing procedures while the technical group focused on basic programming concepts. In the final class, all participants were posttested using the same diagnostics as the pretest.

Results

The indexing of occupations has created geographically relevant labor market information and led to actual labor market participation by students in a temporary setting.

To date, the results support the reliability of the methodology developed. Methodological reliability in terms of a pretest-posttest has been applied to only one group. The Spearman Rank order correlation of rs = .60, p ¼ .01 indicates test/retest reliability for the pretest-posttest being used.

Preliminary results specific to the student population show an average increase in test scores of 8.5 points or a 56% increase in the test score individually. Group results indicate a 98% increase in mean score. Information area increases were equal with a 66% increase in both computer literacy and career exploration areas.

Discussion

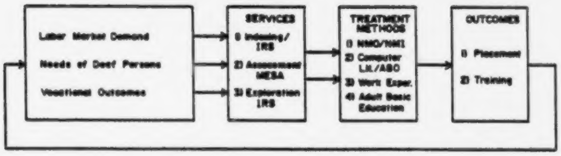
The results indicate that the methods being employed are effective for assisting workers and students in the acquisition of labor market information, occupational information and basic computer use skills. As the subject population is limited, no definitive statement can be made regarding the strength of the relationship between the acquisition of the information and the impact this has on the individual's success on the job or in training in a specific occupational area.

Implications for the application of one method, the Index Rating System, relates to other vocational service programs. The addition of the Index Rating System has required some changes in the format and interviewing in the job development area. Use of the computer to store and retrieve this information has resulted in a more organized, time saving method of reviewing employer contacts. The addition of the VALPAR Access Profile has allowed for a more comprehensive initial approach with employer contact. Employers have reported that they perceive a greater effort to understand their specific needs. The implication has been that both sides involved have a clearer understanding of client and program needs.

This approach to employer contact also supports the development of ABE methods. The model being developed attempts to incorporate (job) vocational specific reading, math and language requirements as part of the ABE training. The project goal is to create a functional and tangible ABE program for participants. Participants will have a chance to improve academic skills and become more competitive employees. As an added feature, academic materials are provided that the client automatically sees as useful.

Finally, the validation of the interaction between labor market demands, disability needs, and vocational outcome results in a process model. This model can be represented graphically:

It is important to recognize that in order to transfer this model: 1) local labor market indexing must be completed, 2) disability specific needs must be identified, and 3) disability specific services must be developed.


Labor Market Demand
Needs of Deaf Persons
Vocational Outcomes
SERVICES
1) Indexing/ IRS
2) Assessment/ MESA
3) Exploration IRS
TREATMENT METHODS
1) NMO/NMI
2) Computer Lit./ABO
3) Work Exper.
4) Adult Basic Education
OUTCOMES
1) Placement
2) Training

This model and activities represent only the initial phase of the project. Further activities will include the application of this model to workers in transition groups. It is assumed that modifications will arise from the changing needs of clients, and the labor market.

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A PLACEMENT AND MANAGEMENT INFORMATION SYSTEM FOR LOCAL PLACEMENT PROGRAMS

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ABSTRACT

A placement and management information system (P/MIS) is under development for a network of Projects With Industry. The P/MIS is designed to serve three purposes for placement specialists and managers of placement programs: (1) provide placement personnel immediate access to up-to-date information on jobs/employment opportunities within their locale; (2) provide placement personnel immediate access to up-to-date information on handicapped persons seeking employment within that locale; and (3) provide managers with collated statistics and reports of placement activities at placement offices serving a locale or region. The P/MIS was conceived to be modified to accommodate a local placement effort's methods of documenting and classifying both job and person data. It uses DBase II, a widely available data-base management system, and is designed to run on either an IBM-PC or IBM-XT. The P/MIS was developed and is being tested collaboratively by the Research and Training Center, University of Wisconsin-Stout (Menomonie, Wisconsin) and the Electronic Industry's Project With Industry, Electronics Industry Foundation (EIF/PWI, Washington, D.C.).

This paper-demonstration covers the origin, development, status, specifications and examples of the P/MIS's current applications. First, the paper overviews the development, structure and specifications for the P/MIS, along with examples of applications for the system in the EIF/PWI. A demonstration of P/MIS's data entry, search, edit and reporting capabilities follows. Questions and potential applications of the P/MIS in local placement activities are explored to complete the presentation.

Origin of P/MIS

In 1982, the Research and Training Center initiated a line of research that focused on the placement of handicapped persons in competitive employment. Under that line, the Center would explore, from both the perspective of the handicapped person and the employer the incidence and problems associated with accessing and retaining jobs. As those research efforts were defined, we found considerable attention being given to developing computerized job-person matching systems. Such systems (Botterbusch, 1983) were almost exclusively based upon use of the coding system developed by the Department of Labor for classifying the 13,000 plus job titles listed in the Dictionary of Occupational Titles (DOT). The jobs were clarified by temperament, demands and aptitudes required. In order to accurately use these job-person matching systems in a local job market, job analyses would be conducted to determine and subsequently code, the characteristics and demands of each job. This insured that jobs available in the local market were accurately classified, even though they may have the same titles as ones listed in the DOT. The skills, abilities and job histories of applicants also needed to be encoded. By using various statistical algorithms with the individual profile, a probable match or series of matches between the person and DOT encoded jobs was then derived. The computerized job-person matching system represented a major advancement in placement technology. If vocational evaluation data are conscientiously used as inputs and if the job-person searches are used for exploration and counseling with a handicapped person, the range of occupations that might be available to handicapped persons can be considerably enlarged. Counselors, placement specialists, vocational evaluators, and handicapped persons can use these systems to discover transferable skills, aptitudes and temperaments. Transferable skills could possibly be applied in a range of jobs and occupations never before considered.

These computerized placement systems depend on DOT classifications of jobs. They work best when both data on jobs and data on applicants accurately relate to that coding system. Elaborate classification systems do not, however, easily solve the placement problem often faced at local levels: the problem of matching individuals with jobs when neither applicant nor position has extensive data.

Placement personnel have indicated to us that a clinically-oriented approach was typically used in these cases. Files of information on applicants, were consulted, reviewing the work histories, training experiences, functional problems, and economic and employment needs. The placement specialist worked with a relatively limited number of employers. With those employers maintained direct contact, developed an extensive knowledge of preferences and needs, and obtained a dynamic understanding of the jobs available, the general demand for those jobs and reasonable accommodations and benefits that could be expected to be made. The placement specialist were unlikely to conduct an extensive job analysis to acquire the depth of information needed to encode a specific job using the DOT system. They were, however, likely to have the extensive client information required to do a computerized person-job match. What we found missing from computerized systems were software designs that assumed the placement specialist would use a clinical-approach when trying to match people and jobs (in contrast to using a computerized-approach. Such systems could be accommodated to a local setting and would actually help placement specialists build on their use of clinical skills.

Overview of the P/MIS Development

The Electronic Industry Foundation's Project With Industry (EIF/PWI) established a network of PWI placement programs in key cities around the country. Each PWI was primarily tied to the electronic industry within the geographic area. While each area office would operate independently, loosely affiliated with the national EIF/PWI, all would conduct placement under a common "brokerage" model. Under the brokerage model, each PWI would be responsive to employer needs for new employees and to the needs of handicapped persons for meaningful employment. Awareness of both needs would be maintained through regular meetings of advisory committees that included representatives from industry and rehabilitation agencies (facilities, vocational rehabilitation programs, community groups). Functionally, the PWI would serve as a broker between industry and community resources by keeping track of the jobs available and the handicapped persons that could perform the jobs. The PWI would screen (clinically) both jobs and applicants for best matches, and refer handicapped persons to the jobs for which they were best suited. These PWI's used information provided by referring rehabilitation programs information provided by employers, and any other information on both the handicapped person and the job they could retrieve through site visits to the employer or through questioning the referring agency and potential applicant.

Most of the basic concepts which were integrated into P/MIS originated from collaboration with EIF/PWI. The basis for the system evolved from several sources. First document reviews and interviews were conducted during site visits to several of the EIF/PWI area offices. Conversations and interviews were also conducted with industry leaders and their personnel office staff. Finally, information was gathered during ongoing conversations, discussions and reviews with the EIF/PWI national staff, particularly Dan Sheehey, Senior Field Supervisor for PWIs. From this we developed what is best referred to as the "worst possible case." We tried to conceive both the full structure of a clinically-oriented placement system and the full set of variables which should be included if that system were complete. While reviewing the features and structures described below, it is apparent that we achieved this objective for P/MIS development. Time and effort was expended to elaborate the concept, review its logic, commit to its development, and aid in its testing by EIF/PWI. The P/MIS will be implemented and evaluated in the EIF/PWI network. However, as you will see, the structure and software system can fully meet the needs of many different kinds of placement efforts. Our development plans call for demonstration within the EIF/PWI network over the next year. Evaluations of that demonstration should indicate its usefulness for other placement programs with an ongoing need to track handicapped persons and jobs and formulate best person/job matches in their community.

Features, Structure and Use of the P/MIS

Basic Features

The P/MIS was developed using DBase II. Our intent was to allow it to be used by people with very little familiarity with microcomputers and no computer programming experience, as well as by more sophisticated micro users. For the novice, it was to be simple and workable. For the users experienced in P/MIS (or DBase), its use could expand with their level of skill development. The seven basic features (fully or partially developed) of the P/MIS are as follows:

1. Menu driven. All the functions and capacities of the system are linked together through a series of explicit menus. Similar kinds of activities (e.g., adding and editing specific files) are contained on the same menu. The user can branch forward or backward from menu to menu to enter, edit, search or report data contained in the system. The user can quit P/MIS from any menu.
2. Modular design. The P/MIS is a series of small interrelated files. Each file (applicant, job, or employer) contains a limited, but highly related set of information (e.g., all data on wages, working hours, and fringe benefits for a job are together). The files are linked together under a hierarchy. Because each file is small, a modular approach increases the speed with which individual and linked files can be searched. Equally important, though, is that the modular approach also makes it possible for the experienced user to delete unnecessary files or link in new files as local needs require, using DBase II. For instance, in a rehabilitation facility, a comprehensive vocational evaluation may be conducted on many applicants for placement. A separate, linkable file could be established to retain this information in a form compatible with codes used in the Dictionary of Occupational Titles. This module would then become the basis for exploring occupational alternatives present in other systems like the Automated Information System, Interstate Job Banks

or the state Occupational Information System.

3. Full screen entry. All data are entered, added or changed using pre-formatted screens. Each screen corresponds to a data file. On the upper portion of the monitor a form is presented. This form looks very much like a typed page. Each variable is fully described on the form and spaces are provided for appropriate information entry (e.g., if money is to be entered, only numbers can be entered). prompts are displayed beneath the formatted screen describing the information to be entered, the types of values allowed or lists of codes that must be used. All information about an applicant or employer can be entered at one time; movement to successive screens occurs automatically when the user is in the data entry mode.
4. Full screen updating. All screen (and therefore files) can be edited or have records selectively added as information changes or increases. For editing, the contents of a specific screen are presented and only those fields requiring correction need be altered when updating takes place. Additional records can be conveniently added (e.g., new job entries for an employer) without reentering all other information. Again, the specific formatted screen and corresponding prompts are presented. A reasonable set of subroutines help to assure that duplicate information is not entered.
5. Searching and displaying records. Searches can be conducted on any variable contained in any file. A search may be conducted for an exact variable contained in any file. A search may be conducted for an exact value of a variable (e.g., JONES, JOHN, A), a number of entries having a certain string of characters (e.g., all names beginning with JO) or a number of specific entries (e.g., several different names). The results of these searches can be saved on disk, displayed on the monitor, or reproduced in hard-copy. A basic set of searches typically conducted are included for the novice user. More complex searches can be developed by the mature user using variations of DBase II's FIND and LOCATE functions.
6. Archive records. A historical record can be produced for each applicant or each job/employer once that job/employer is removed from the system. These archived records are intended to provide the manager the capacity to evaluate the productivity of individual staff members and the program's use of its key job and applicants sources. A typical record would retain information on who, what, when, amount of activity and outcome for either the applicant or the job. More complete/complex archive records can be designed by the user.
7. Reporting. Reports can be developed which quantify information on the characteristics and job seeking activities of applicants or on the specific jobs and employers maintained in the local P/MIS. A minimum set of standard reports are planned which summarize process data and outcome

data on applicants, jobs and employers. These reports can be produced on a monitor, printer, or disk file. This report feature also provides a method for transmitting summaries to other micro-processors equipped with communications packages, DBase II and P/MIS.

Contents and Structure

When this system was designed, we attempted to include all types of relevant information that may conceivably be included about jobs and applicants. However, we realized that not all of this information would be used by some placement programs. Because P/MIS is modular, information which is ultimately retained under an adapted P/MIS is restricted by the needs of the local setting. In practice, if a file/screen of information is not needed, that module can be deleted. Likewise (in theory, as we need to test this feature), if information on applicants (e.g., family size, referral source) or on employers and jobs (e.g., descriptions of product lines, which jobs are actually included, work shift, benefits packages) contained on a given screen, is not needed, then those parts of the system can also be excluded without detriment to P/MIS's abilities. Because all information is local and entered and maintained locally, what actually is used determines what is included in the P/MIS.

As an interactive placement and management system, P/MIS was conceived to allow placement personnel to deal with information on jobs and applicants in very much the way that a placement specialist would describe an employer's needs and requirements or an applicant's skills, capacities, needs and restriction and then work with that information to find a job for a person, or persons possible for a series of jobs. While conventional coding systems can be used (e.g., DOT), its search capacities do not require elaborate encoding of jobs and applicant work histories or skills. We designed it expecting that the people are more likely to use it if "real word descriptors" are the basis for the system. Whenever possible, the user is expected to enter English words and descriptors for jobs and applicant variables. These descriptors are searched and provide the basis on which the placement specialist identifies potential applicant-job matches. There are two major sets of files on the P/MIS: applicant files and Employer files. P/MIS allows the user to search the Applicant files, for an individual, persons with similar characteristics (skills, training, experience, functional limitations), persons with different economic and compensatory needs, or search to determine file activity and status in job seeking. Likewise, P/MIS allows the user to search the employer/job file, seeking jobs which require certain attributes (work history, skills, experience, training, working conditions) or provide specified advantages (level and quality of job, wages, benefits), seeking employers which conform to specific regional considerations or to survey employer hiring practices within the service locale. Finally, updating and off-loading capabilities allow managers to produce individual applicant or employer profiles, produce quarterly and annual placement summaries, and develop custom reports based upon both applicant and employer activity.

Figure 1 provides an overview of the general structure of P/MIS. As is evident, P/MIS is a two-sided system of information on Applicants seeking jobs and Employers with jobs. Each separate box represents a screen (and file) of information the placement person would see when inputting or examining information on a job or applicant. The small boxes, labeled "A .... Z," indicate that there can be multiple records in the file for the applicant or employer. For instance, an Applicant may have several Work Experiences and an Employer may have

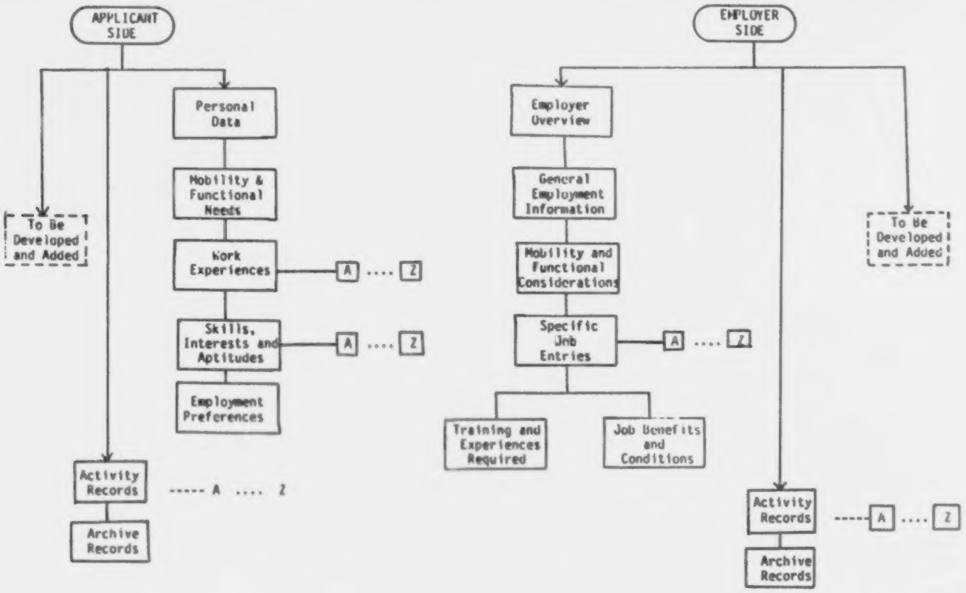
APPLICANT SIDE
Personal Data
Mobility & Functional Needs
Work Experiences
Skills, Interests and Aptitudes
Employment Preferences
To Be Developed and Added
A .... Z
A .... Z
Activity Records
----- A .... Z
Archive Records
EMPLOYER SIDE
Employer Overview
General Employment Information
Mobility and Functional Considerations
Specific Job Entries
A .... Z
Training and Experiences Required
Job Benefits and Conditions
To Be Developed and Added
Activity Records
----- A .... Z
Archive Records

Figure 1. Structure of the Placement/Management Information System.

many Job Entries. At the bottom of Figure 1, boxes, Activity Records and Archive Records, are produced for management and market research purposes. An Activity Record is produced whenever an applicant is referred for job interview and contains elementary information on who is referred, the job and employer, on prospective wages and benefits, and on outcome of the job referral. The Archive Record is produced (for permanent storage) for either the applicant who left the system or the job removed from the system. The record summarizes activity information, wage and benefits information, outcome or placement results, and provides limited abstracts of basic applicant or employer data.

On each side of the P/MIS, several different screens (and files) are related to each other by a hierarchy. On the Applicant side, Personal Data is at the top of the hierarchy as this file (also screen) contains basic information on the applicant, where he or she lives, and his or her demographics (e.g., age, education, ethnic group, VR status); this data is generally unchanging. This screen/file is followed (linked is another way of describing this relationship) by information on the applicant's Mobility and Functional Needs, including disabilities, ability and desire to travel, restrictions imposed by disabilities. Each of the applicant's work experiences are separate records in the Work Experience file. These records contain information on skills used, occupational area, level of employment, tenure, reasons left, general working conditions, and wage and fringe benefits received. Each specific attribute possessed by the applicant is also entered in the Skills, Interests and Aptitudes file as a separate record. This file retains information on work relevant characteristics of the attribute, such as amount, type, length and outcome of training and specific skills or aptitudes which might be transferable. The Employment Preferences screen/file details the type(s) of jobs, occupations, vocational roles and working conditions the applicant would prefer and the extent of wage and fringe benefits the applicant would need.

On the Employer side of the P/MIS, the hierarchy begins with three single screens covering the most general, unchanging features and provisions of an employer. The first screen (file), Employer Overview, stores and presents basic information on the company or corporation: where it is located, typical jobs that are available, its general products or services, names of other divisions of the corporations, and such information as may be of interest to a placement person as they survey companies for potentially placing applicants. That screen is followed by the General Employment Information screen. General Employment Information relates to where and who to contact at the personnel office, tips on how to get to the personnel office, and the types and annual value of various fringe benefits (insurance, retirement, training, paid leave) available to employees. The next screen (file) details Functional Considerations which the employer can make for employees. This information includes details regarding accessibility to and on the worksite, employer preferences regarding disability groups, functional limitations which can be accommodated by the employer and availability of public and company provided transportation.

For each job the employer has available (as opposed to the jobs which the employer may have), there are three separate screens. First, Specific Job Entries lets you know the total number of different jobs available with the company, the name of the job, its occupational area, the level of the job, a brief description, its priority and eligibility for tax credit, some general comments about it, data on number of persons needed for the job, and a projection of the job's future with the company. The Training and Experience Needed screen details the minimum educational level required, typical types, time and outcomes of training which are acceptable, and typical job experiences, tenure and skills which would be useful for the job. Finally, Job's Benefits and Conditions summarize information on when and how regularly a person would work, the specific fringe benefits to be provided, and the annual value for wages earned, for fringe benefits and for wages and fringe combined.

One might begin a typical job-applicant match by looking for all employers which typically employ people as ASSEMBLERs or ENGINEERs (search Type in the Employer Overview file) or for all employers who currently have such jobs open (by searching on Job Title in the Specific Job Entries file). Once a number of potential employers are found, a variety of information about the employer and those jobs might be displayed and examined, printed in hard copy or saved to be used in your search for qualified applicants. For instance, you might want to know whether all jobs were at one employer or the age offered by various fringe benefits packages at different employers. You might next go to the applicant side of the P/MIS to develop a list of potential applicants. A search of the Work Preference file for applicants who list ASSEMBLER or ENGINEER as jobs in which they would be interested might produce a reasonably sized list of potential applicants. Before contacting any of the applicants or referring them to the employer, you might want to determine whether the employer(s) can meet their functional needs, by contrasting what is in each applicant's Functional Needs file with what is in the employer Functional Considerations file. Then, too, you might want to decide which of the employers can meet their wage and fringe benefit needs, as determined by contrasting the benefits listed in the applicant's Work Preference file with those listed under Benefits and Working Conditions for the job. If a small number of possible applicants were identified, you might at this point contact the employers and applicants to see whether a referral is desired.

Should no reasonable matches be found, your search might expand to your list of potential applicants. A greater number of potential applicants might be accumulated for instance, from searches of both the Work Experience and the Skills, Interests and Aptitude files.

Whether one started the search from the applicant side or the employer side, the same outcome could be achieved, because of several considerations made in P/MIS's design: First, similar kinds of information are placed together. The screens of information one reviews are based upon how the information is likely to be used in placement. For instance, training and work experience needed for a particular job are often examined together; wages, hours and fringe benefits are considered together; and functional needs and considerations are often evaluated separately from wages. This results in smaller files which make it possible to rapidly search for information in each file. Second, the similarities that exist between the information one would use while looking for a job to that which would be available on jobs being offered by an employer were particularly considered and stressed in designing each side of the P/MIS. Occupational areas covered for jobs available could be searched to find ones which are similar or identical to ones in which an applicant might have had work experience or have been trained. Fringe benefit needs of the applicant could be compared to fringe benefits options available from different companies to identify the best match. Work Experience and Job Preference files could be searched to find applicants who might be prospects for a particular job.

Third, the use of English words and word chains in attempting person-job matches are integral in the majority of searches. For instance English words and descriptors are used to name, describe jobs, skills, training, work history, interests, work preferences, occupational areas, job levels, training and experience requirements. Fourth, as a menu format is used to facilitate movement between entry, editing and search functions, a menu format was also designed to guide the user through the typical searches. A search for information on job availability in a given company only requires entering the name of the company and the title of the job. A search across P/MIS for all jobs of a particular kind requires entry of the job name (or a string of characters) and designation of which screen/file is to be searched.

Finally, although specific files contain data on only a few variables, files on each side of the system can be linked, the results of the search accumulated for subsequent display and/or print out. Searches can then be made of the opposite side of the system. More complex searches can be formulated by the user as P/MIS is developed under DBase II, which has powerful file searching capacities. As the user acquires experience using P/MIS, greater use can be made of P/MIS through development of increasingly fine tuned file searches.

Applications and Adaptation to Local Use

We envision the P/MIS applicable to a variety of settings, either as part of a total information system or as a stand alone placement system. Among the immediate applications we see are:

1. Placement programs and placement services. These are the groups for which the P/MIS was originally developed. Local placement programs, whether publicly funded or funded on a fee basis, typically work with a finite set of employers and jobs referred by those employers. The P/MIS provides the capacity to build an on-going base of information on available jobs, benefits, and needs with this set of employers. Information on individual

employers can be amended as greater precision is achieved regarding the employer requirements (skills, abilities, preferences), working conditions (functional needs which can be met), and benefits (wages, various fringe benefit packages). Likewise, the P/MIS format can be used in a structured interview with potential applicants. With assistance, an applicant could conceivably enter his/her own data. Data acquired from applicants and employers could be shared by several employment/placement specialists.

2. Vocational rehabilitation counselors doing placement. Like private placement programs, a vocational rehabilitation counselor typically uses a key set of employers (augmented by additional job information from various sources). Almost all of the information contained in the applicant side of the system relates to those variables the counselor will most often address, as job and career options are explored with a client during his or her rehabilitation. Use of the P/MIS by a counselor can begin quite early in the rehabilitation process; by the time employment is viable, information on client's skills and needs could be very accurate and greatly increase the likelihood that the client would be placed in a position commensurate with his/her job and career goals.

3. Rehabilitation facilities and sheltered workshops engaged in placement. Facilities and workshops are increasingly engaging in placement activities with their client populations, either under contract with various state agencies or as an independent function. The P/MIS can be the core for a more expansive MIS for facilities as modules (linked files) are added to it to keep track of production, wage and hour data from work adjustment training, vocational evaluation findings, other service data, and financial data. As would be the case for the rehabilitation counselor, a comprehensive picture of the client can be acquired under typical facility and workshop programs and greater precision accomplished in identification of job options which are preferable for each client. As with both a regular placement program and a vocational rehabilitation counselor, the facility placement personnel will typically relate to a finite, ongoing, core set of employers. The P/MIS allows the facility placement person to mature in his or her acquisition and use of information maintained on the local employment market.

4. Other potential applications. The range of applications is only limited by four factors: First, the primary approach to placement assumes a clinical review and matching of applicants with employment options, rather than use a completely mechanical person-job process. Second, a primary core of employers must be identified and developed within the local service area. Third, the staff in the local office must agree upon descriptors and labels they will use for certain person and job variables (e.g., for skills, occupational areas, demands, functional limits and level of work).

Fourth, placement is an ongoing activity, sufficient numbers of applicants (25 to 50 per year might be reasonable) and a sufficient number of core employers who have various job needs must be available to justify investing in the equipment and software.

If those factors are present, then some of the potential applications of P/MIS might be made by the following: Hospitals and outpatient clinics serving deinstitutionalized and traumatically affected persons, private rehabilitation services, corporations and industry doing in-placement and out-placement of their own disabled or displaced workers, schools and training programs transitioning handicapped students to the world of work (both for occupational exploration and placement), community and consumer groups active in placement, and groups maintaining an ongoing survey of a community's resources (people and jobs).

Specifications and Requirements for Installation of P/MIS

The P/MIS was designed to be used with Aston-Tate's DBase II Relational Database System. DBase II is widely available in formats for most microprocessors (e.g., Apple, IBM, Radio Shack, Hewlett Packard, etc.) and can be used for many applications other than the P/MIS (e.g., bookkeeping, mailing lists, inventory control, custom programming). While it retails for $700 from the manufacturer, it can be acquired from some suppliers for under $500. In theory, code for running P/MIS under DBase II should be usable on any micro for which there is a version of DBase II. We have not tried all systems, however.

The microprocessor on which we developed the P/MIS was an IBM-PC. The minimum requirements to use the full P/MIS as it is presently configured includes an IBM-PC with two 320kb drives, 128k memory, a Hayes 1200b modem (with Smartcom II), and Epson FX-80 dot matrix printer, a display (monochrome, color or graphics) and 10 double density, dual sided disks. The P/MIS is currently contained on 4 disks: Two program disks (one each to hold DBase and the Applicant and Employer programs) and two data disks (one each to hold database and indexed files for Applicants and Employers). The remaining 6 disks are for back-up of the program and data files (4 disks) and to archive purged records from the Applicant and Employer sides of the program (2 disks). Cost for such a configuration would run between $3200 to $4000.

Displays of formatted screens are very similar on color, graphics, and standard monochrome monitors. Monochrome provides the greatest detail (blinking, fore/background, underlining), color the next best (because of alternating definition of input/fixed data), and graphics the least preferred (bright and light characters tend to loose definition).

The Hayes modem is not necessary unless part of your need is for interlocation information sharing or if you intend to use information in your P/MIS while accessing the various occupation, training and job banks (e.g., you state Occupational Information System) or any of the computerized national placement systems (e.g., Automated Information Systems out of Spokane, Washington).

While the P/MIS is designed to run as a two-sided (Applicant and Employer) database system on an IBM-PC, it is more efficiently run on an IBM-XT with its 10 meg hardisk or an IBM-PC with a 5 or 10 meg hardisk add-on. With either of those hardware configurations, no disk-switching is required; both the Applicant and the Employer programs and databases can be accessed from one set of menus. This is the most preferred arrangement, as applications for matching potential-jobs and potential-employees are most direct and considerably faster. This configuration (with similar peripherals as above), runs around $4500 to $5500.

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MISSOURI LINC ASSISTIVE DEVICE SERVICE

MALCOLM FLANAGAN
DONNA DUNAFON

ABSTRACT

Missouri LINC is a state funded project providing various support services to Missouri Vocational and Special Education teachers secondary who are teaching vocational skills to handicapped students in secondary and postsecondary institutions. These services include adaptive devices.

Missouri LINC Assistive Device Service is one component of a state funded technical assistance program that assists vocational and special education teachers in the preparation of special education students for employment. The assistive device service, however, is the one component that is designed for preschool through postsecondary school levels. The remaining services will be identified in order for the reader to understand the structure of the total program. Information Assistance includes the collecting and retrieval of resource materials, an incoming WATS line (in-state only), SpecialNet (MOLINC, a state electronic bulletin board and VOCED, a national electronic bulletin board), and booths at state meetings. This information dissemination includes assistive device information products as well as products from the program as a whole. Publications include bi-monthly newsletters, two page teacher-oriented publications with resource lists, and papers or manuals. The latter are designed to provide assistance with pressing issues. Consultation is available for a limited number of school districts per school year where LINC staff visit with school staff, on site, to assist in improving services. A plan is developed and followed by LINC staff. From consultations, two major activities have developed that have state-wide significance. Courses and Conferences range from credit courses to one and two day conferences. Transition to Work is a component new to the program in 1984. This component is being developed together with one public school district as a demonstration program. Entry Level Skills Criteria Project training is a major component for the 1984-85 school year. This is one of the components that grew out of consultative services. These entry level skills criteria, originally developed by area vocational-technical school instructors, and instructional materials, developed by special education instructors, have gained sufficient attention that approximately twenty percent of the school district staff in the state will be trained in their use during the development activities carried out each year in relationship to selected components.

Assistive Device Services

These services may be used by school district personnel with either the in-coming WATS line or Special-Net. When requests are made, staff ask a limited number of questions in order to clarify the needs of the student, they then research the request and provide information to school personnel. Services are informational only, as qualified professional specialists are not members of Missouri LINC staff. The information usually contains data about assistive device/adaptive sources for the purchasing equipment, lists of distributors in or near Missouri, and consultants who provide services for a fee. Conference presentations and workshops are available upon request by local education association staff or professional organizations. Commercial distributors have been especially cooperative in providing display equipment at all presentations when requested.

The largest number of requests have been for communication devices. Other areas where requests have been made in fairly large numbers are, computer access, enlarged print, and writing aids. Requests have also been made for devices to help transport students safely.

Because many people requiring our services have limited knowledge about the technology available to assist them, Assistive Device Service staff have attempted to help public school professionals (teachers, speech therapists, school administrator's) clarify their needs. A one-page worksheet that includes items for defining the handicapped individuals strengths and weaknesses, environmental considerations, and solutions as well as some practical matters such as portability and accessibility. The worksheet is included as Table 1 at the end of this article.

One of the most exciting endeavors Missouri LINC Assistive Device Services staff have been involved with is adopting a work station for a young woman with cerebral palsy. This young woman came to Missouri LINC in 1981 as a trainee in data entry work. She could not operate the keyboard in a conventional manner due to poor control. Keyboard modifications were, therefore, made. In 1983 the Assistive Device Service staff became involved with providing the most efficient input system for her. Exploration included evaluating voice recognition possibilities and scanning devices. These modes were rejected after a long evaluation. She is now using a new model of an adapted keyboard and a more practical head-stick. She is employed at Missouri LINC as a part-time Data Entry Operator I. Most of her job is performed independently. One function she still requires assistance with is placing floppy disks in disk drives. Research will continue until she is as nearly independent as our capabilities will allow. Copies are available at no cost.

Summary of Detailed Study and Summary of Research and Results

Missouri LINC Assistive Device Service is a low budget service designed to provide information to teachers and parents of exceptional children. Information is distributed throughout the state through newsletters, other publications, displays at conferences, and presentations to school staff and conference participants.

ASSISTIVE DEVICE SERVICES

609 Maryland
University of Missouri-Columbia
Columbia, Missouri 65211
800/392-0533

Guidelines for Selecting and Locating Assistive Devices

Name________________________________ Age__________

1. Define the problem.______________________________

____

____

2. Possible Solutions

a)____

b)____

c)____

3. What does the device need to do in order to best tap the strengths of the student?

____

____

____

4. Target Area of Need. Check all appropriate areas:

_____Academic	_____Home
_____Vocational	_____Other
_____Recreational	

*List specific settings that present problems.

____

____

5. Program Considerations

Yes	No	
___	___	Will modifications or adaptations effectively increase productivity?
___	___	Can adequate training time be provided for the introduction of the device?
___	___	Can staff be provided to carry out training?
___	___	Is there adequate space for the device?
___	___	Is accessibility a problem? Please specify.

____

Other Concerns:______________________________

____

6. Consult with Support Staff and others.
   - Teachers
   - Physical Therapist
   - Occupational Therapist
   - Parents
   - Community Contacts

Do any of these people have ideas or materials available? (Many times, there is a wealth of talent in your own community for building your own device)

7. Contact other sources for additional information.

-Missouri LINC Assistive Device Services 1-(800)-392-0533
-Local medical/hospital supply companies
-Local Hospitals*Occupational Therapy/Physical Therapy Depts.
-Rehabilitation Services
-State Department of Education-Consultants 1-(314) 751-4909
-Local Service Agencies:
    Lions Club - Vision
    Optimist Club - Hearing
    Bell Telephone Pioneers - Engineering
    Others...

8. Contact Distributors

*Have you explored the possibilites of hands-on experience? (Many companies will loan equipment for try out purposes for up to two weeks.)

*Invite the sales representative to come demonstrate the device with the student.

*Spend as much time as possible training on equipment to determine its effectiveness.

9. Consider Cost and Contact Funding Sources

Have you contacted:
_____Insurance Companies
_____State Department
_____Local Service Agencies
_____Rehabilitation Services
_____Parents

10. Purchasing Equipment

What services are provided by the company?
_____Warranties guarantees
_____Local Representative for Servicing and Maintenance
_____Loan/Lease
_____Other Services

Is the device expandable in terms of its capability to "grow with the student".

*When purchasing microcomputer assistive devices, consider its ability to interface with either existing or other systems.
Prepared by:________________________________

EMPLOYMENT OPPORTUNITIES FOR THE HANDICAPPED IN PROGRAMMABLE AUTOMATION

RICHARD SWIFT
ROBERT LENEWAY

ABSTRACT

The possible uses of numerical controls interfaced with computers include the opening of employment windows for persons with severe disabilities. Areas that show promise are computer aided design, computer aided manufacturing, computer aided engineering, computer integrated manufacturing systems, and programable automation. Numerical control systems are described and their occupational outlook examined. The potential of these employment areas to be filled by a workforce of persons with severe disabilities is great, but educational steps must be quickly taken.

Ben Cey, a bright 22 year old exmachinist from Flint, Michigan, came to Michigan's State Technical Institute and Rehabilitation Center (STIRC) in 1978 after a diving accident paralyzed him from the neck down.

Ben came from a family of metal working auto makers. His father was a tool and die maker, his brother a welder, and grandfather a retired foreman in a local GM engine plant. After graduating from high school, Ben got a job as a milling machine operator and was paid a higher wage than the 12% of his classmates who went on to college could expect to earn after college graduation.

That was before his accident made his old job unaccessible. Ben's vocational rehabilitation counselor referred him to STIRC for a new program to train the severely handicapped in computer programming. This project was initiated with the assistance of the IBM corporation and the West Michigan Data Processing industry. It appeared to offer great promise for Ben in retraining to become a business application computer programmer.

In spite of good aptitude scores, extensive interviews and much hard work, Ben was failing in his "only chance for a good career." In a termination meeting with the center's staff that included Ben and his parents, it was suggested that perhaps numerical control (NC) programming might be an alternative for Ben to try.

It wasn't very long into this pilot program when it became apparent that a high level quad like Ben could be trained. One of the biggest problems encountered were sketches and drawings. Mouthstick and CP drawings were often unrecognizable. In the meantime, however, the center drafting program was desperately trying to survive technical obsolescence with the introduction of Computer Aided Design (CAD) to the industry. With some special help from the State Rehabilitation Office in Michigan the center acquired four CAD stations with plotters. The addition of these CAD stations also provided an answer to the problem with drawings by students with upper limb physical impairments. The real question: Could a quad be placed? was answered when the AC Spark Plug Company hired Ben as an NC programmer. Since that time, other severely handicapped students have been successfully trained and placed in the manufacturing industry as NC programmers.

A Computer Integrated Manufacturing System (CIMS) that will link two language graphic terminals through a DEC computer to both a N.C. controlled milling machine in the Machine Tool training lab or a three dimensional CNC router in the Cabinetmaking Shop has been purchased and should be installed in 1985. With a CIMS system it is conceivable that a high level quad like Ben could use a mouthstick on a graphic tablet to custom design, machine and manufacture either wood or metal parts from his bed at home. This capability comes at a time when the new "just in time" inventory systems are demanding that suppliers automate into CIMS or evaporate.

NC-CNC-CAD-CAM-CIMS-CAE-PA

"NC" Numerical Control Programming

NC dates from 1951 although it did not become widespread until the middle '60's. Prior to 1951 most machine tools were hand operated/controlled or equipped to make one part automatically, continuously. This type of mass manufacture certainly played an important role in this country's development but required large expenditures for single purpose machines and necessitated long production runs and large inventories. Henry Ford's Model T comes immediately to mind - all identical, made for years.

As in common with most new processes it was originally believed NC would quickly "take over" and relegate conventional machine tools to the scrap yard. However, many of the new NC controls were difficult to program, broke down, and were difficult to repair as they required a service person well versed in electronics-hydraulics and mechanics. The need for this type of service person still plagues the industry.

Programs for early NC machine tool controls were developed manually. Lengthy mathematical computations and complicated geometry/trigonometry sketches/mechanical drawings were the order of the day.

Computer Aided NC Programming moved out of the laboratory testing environment and into manufacturing about 1964. In common with NC's beginnings, early attempts at Computer Aided NC programming were troublesome, frustrating and costly. Many languages were promulgated, virtually every machine tool or control manufacturer had a proprietary language, usually they ran only the owners brand of machine tool or control.

In order to program a shop full of various makes and types of machines, management was saddled with five or six languages; costly and cumbersome at best, this was often a nightmare.

In the early 70's languages that would operate a wide variety of machine tools became available. Again, many were offered but few survived.

NC languages are generally identified/classified by the number of axes they will control. General manufacturers use 2 to 3 axes while sophisticated aerospace-defense industries use as many as eight. There are only three general, axes length-width-height, but any tool or part inclination/rotation is considered axis.

"CNC" Computer Numerical Control

A CNC control basically is a standard NC control:

1. Equipped with a keyboard so that programs can be entered or modified and,
2. Equipped with a memory to store programs or routines, and,
3. With several computational functions built into the control.

It is "smart" control, if you will. Most CNC applications are in small shops that do not have a programming department nor access to a computer. CNC controls are not as capable as Computer Aided NC Programming but they are Better than manual machine operation and considerably less costly than Computer Aided NC programming either time shared or in-house.

"CAD" Computer Aided Design

This is the creation of manufacturing drawings by use of CRT keyboard light pen and plotter. It replaces drawings done by a draftsman. Systems range from those capable of only simple drawings to those with analytical design abilities capable of lengthy mathematical computations.

CAD/CAM, CAE, CIMS

These attempt to merge design drawing, and engineering areas with NC programming. Basically they create the NC programs at the same time that the drawing is created.

CAD-Computer Aided Design
CAM-Computer Aided Manufacturing
CAE-Computer Aided Engineering
CIMS-Computer Integrated Manufacturing System

PA-Programmable Automation merges CAD, CAM, CAE, CIMS with automated production techniques such as robotics and computer inventory retrieval systems.

"NC" Programmers

NC Programmers are generally classified by:

1. Machine tool, lathe, mill
2. The number of axes they can program. A two axes programmer earns about $16,000 to $20,000 and seven axis aerospace programmers about $50,000 to $60,000.

The level the STIRC program provides training for is a 2-3 axes, mill program. The level of mathematics needed increases dramatically as the programmer level increases.

Employment Outlook for PA

In a recent study conducted by the congressional Office of Technology Assessment, the net change in national employment caused by programmed automation "will not be major in the 1990's, it will however have some definite effects on some individuals (like the handicapped) and some regions (such as the Midwest).

The study indicates that the potential long term impact of programmable automation on the number and kinds of jobs available is enormous. However, the Office of Technology Assessment expects that job creation by PA producers to be less than the job loss. This is also supported in a study by Tim and Allan Hunt of the W. E. Upjohn Institute for Employment Research in Robotics. The Hunts' also expect a skill twist; highly trained engineers, programmers, technicians and repairpersons will be in demand as replacements for relatively untrained operators.

So, while P.A. will create new accessible career opportunities for some well trained physically handicapped persons, like Ben, it can expect to bring to light many more learning disabled persons whose problems would not have surfaced in the days of high paid assembly work.

Education

According to the U.S. Bureau of Labor Statistics, 21% of all American workers are still involved in manufacturing (28% in Midwest), thus, production automation can continue to be counted on as a force to reshape American education.

It demands a strong foundation of basic skills to build analytical and problem solving skills. These skill changes indicate the need for effective education and career guidance services for youth and adults to head in the right direction.

Working Environment

While telecommuting (working via terminal at home), is possible, it is not likely to be widespread for a variety of social, management, and traditional reasons. The overall working environment will become more accessible as a prerequisite to automation and less physically hazardous, thus, less work related physical disabilities should occur. There is some concern expressed in the OTA report that relegating the craftsman's skill to an "error free machine" may result in the increase of psychological hazards for some workers. The lack of trained PA workers may affect the rate of growth in PA application. Much more on-the-job training and retraining can be expected to occur on the factory floors.

Sheltered workshops can also expect to feel the impact. At Goodwill Industries in Kalamazoo, Michigan, a CNC router turns out wood parts two shifts a day for the assembly of a variety of high quality products such as wood wheeled, back rollers and computer furniture. These products can also provide increase in self-esteem to the sheltered workshop participants over printed circuit board assembly and/or subassemblies. These high quality products can provide the workshop with profitable return investment that may be used, eventually, for higher wages for workshop employees.

Robotics

Robotics is currently generating a great deal of attention. Very little information is available to assist the vocational rehabilitation/special education community in counseling educators and students for these training programs. How big will robotics be? How quickly will it grow? What occupations will be created? Will unemployment dramatically increase because of robots? Are we training workers whose skills will become obsolete? Does robotics make a good "fit" with handicapped workers? Such questions were addressed in the Hunt study.

In a trade off between job placement and job creation, jobs are semi-skilled and unskilled. The skilled jobs created requires significant technical background. This supports the notion that the future labor market will demand greater skills from workers.

Quite surprising is the presently modest size of the robotics industry. U.S. robot population has been placed at 7,000. Some of the most sophisticated capabilities attributed to robots are not yet in widespread use. Often robots are used with existing automated production equipment.

According to the Hunt study, there is no question that many robotic technicians will be employed. However, most of these technicians will be retrained by the auto industry; little outside hiring is expected. Thus, only a small number of robotic technicians were used in other industries before 1990. An oversupply of robotic technicians because of high student interest is a real area of concern. After all, the function of robots is to eliminate human labor, not increase it.

In examining the robotic positions available, the National Industrial Center for Handicapped Employment (NICHE) reported that changing the motors, gears, and arms of a robot would not make a good vocational fit for most physically handicapped persons. Thus, rehabilitation trainees should avoid embracing this occupation.

Rehabilitation Engineering

With the new CIMS it is possible for a rehabilitation engineer to design and manufacture one-of-a-kind adaptive devices for storage in a data base memory. They could be transferred or changed for similar problems at a later date. It also provides an opportunity for limited production runs that are quick, easy, and cheap, even for small numbers of handicapped persons needing non-mass market devices. This eliminates the need for inventories of such devices; they can now be made when needed.

Summary

The opportunities and challenges of programmable automation are great for handicapped persons, but their future and ours lies in field awareness. It is hoped that this program is a start in that direction.

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AUTOMATING YOUR REHABILITATION FACILITY WITH MICROCOMPUTERS

RITA M. GLASS

ABSTRACT

This apaper presents a systematic way of evaluating facility needs for computers. The uses of computers by rehabilitation facilities are discussed and the automation audit is proposed as a logical first step leading to the use of a computer for an information management system.

Also presented is a the National Easter Seal Society's Storage, Tracking, Analysis, and Reporting (NSTAR) Patient Management System. NSTAR is presented as an example of a special purpose data based designed to deal with information flows unique to the rehabilitation process.

If you are considering automating your agency, I'd like to assist you in making a wise choice.

YOU DON'T NEED TO BE A COMPUTER EXPERT TO BUY THE COMPUTER THAT IS RIGHT for your agency. Be systematic in making your decision.

Six principles to keep in mind when considering whether to automate your agency:

1. DO YOUR HOMEWORK - A smart buyer should learn how a computer works and how to use it. You can acquire this understanding in several ways. By:

   - -enrolling in seminars and classes offered by colleges and universities
   - -reading books, magazines, newspapers
   - -contacting industry groups and associations
   - -joining computer societies and user groups

   The purpose of doing your homework is to give you a basic understanding of computers and how they can be used in managing your agency's total operations.

2. BUY THE COMPUTER YOU NEED Consider the business, office, financial, client and fund-raising management function of your agency.

3. BUY THE COMPUTER YOU CAN AFFORD - Make sure you know the total cost of a computer before you buy it; that the system you are considering must be within your budget.

4. BUY COMPUTER SOFTWARE FIRST - Software is the set of instructions you feed your computer. Find and purchase the software that meets your unique needs as a rehabilitation agency.

5. BUY A PROVEN PRODUCT - Buy software with a proven track record from a company or organization that's secure. Many custom software developers are not going to be around tomorrow. If you purchase a software system, be sure it can be maintained and technically supported by the experts that know your rehabilitation business.

6. TAKE TIME FOR YOUR DECISION - If this is new territory for you, wait until you have the time; preferably, make the time to plan and educate yourself before you buy a computer.

What does a Computer Do?

Basically, computers accept information (input), process the input, file the results, and display or print the results. They do it faster, more accurately, more consistently than people do. That's all a computer does. Now, how does a computer do it?

Most people are surprised to learn that computers are not very smart. They are fast and accurate, but cannot think. The high technology is there simply to detect the presence or absence of electronic impulse. Computers process and store information in terms of these impulses. Groups of impulses are called "memory."

A computer accepts input from the user through a keyboard. The keyboard looks similar to the keyboard of a typewriter.

To process information, the computer has a central processing unit (CPU) and memory. The CPU interprets instructions and manipulates data stored in its memory. It also issues commands to the other components of the computer.

Memory can be RAM (random access memory) or ROM (read only memory). RAM is the memory readily accessible to the user. It's the user's work table. ROM is not accessible or alterable by the user. It can be examined but not changed.

Results of the information filed can be displayed on screen, a television set, or a cathode ray tube (CRT). The keyboard and screen together are known as a terminal.

All of these components of the computer system are known as hardware. They are anything you can bruise your knuckles on. The other components of a computer are known as software, the sets of instructions given to the computer hardware to file information. They are usually on diskettes, floppy, or "soft," square records. There are two types of software: operating and application.

The operating software controls the overall operations of the computer. It translates the information, controls the components of the computer, and keeps track of what's going on.

Application software handles the specific business and program needs of the agency. The computer system you select should be able to run the unique application software necessary to conduct the day-to-day functions of your agency.

All rehabilitation agencies have standard operations similar to those of any business. Their computer software needs are similar to business's. Unique needs relate to their specialized service delivery and fund accounting requirements.

Any computer your agency considers should be able to use available software that meets both standard and unique business/service needs.

Automation Audit

An agency seriously considering automating should first hire a professional computer/rehabilitation consultant to perform an automation audit. This is a computer needs assessment covering an entire agency and all facets of its operation.

An automation audit determines your agency's short and long-term automation needs. Through prioritization of these needs and appropriate allocation of resources, the efficiency and effectiveness of your overall operations can be improved.

An overall look at an agency's automation needs assures that computer selection will be compatible with total software needs.

A good automation audit addresses the necessary phase-in period preceding purchase and software implementation.

Finally, a thorough automation audit assures the purchase of equipment holding computer power (memory) adequate for three to five years that is compatible, upgradeable, and expandable.

The consultant doing your audit should be familiar with personal and multiuser/multitasking micro-and supermicrocomputers.

A personal microcomputer, sometimes called a business computer, is a single-user system; it is a personal productivity tool.

A multiuser/multitasking microcomputer will allow several persons to use the system at the same time. Staff from different departments in an agency can carry out various tasks simultaneously.

Consultants unfamiliar with multiuser/multitasking supermicrocomputers may recommend minicomputers, some of which have memory but are three to four times the price, of personal computers. These often prove impractical for a multiservice agency's business operations.

The automation audit consultant must be familiar with a variety of software in order to recommend the complete set for your facility needs. The software you purchase must be easy to load and operate. As users will likely be novices, the software must be user friendly. Professionals should be able to make it work within a reasonable period of time after studying the manual and practicing. Software that is not well documented should not be considered. Check the manuals that accompany software. Those that are easy to read and well documented can indicate software quality.

Four areas of operation need to be addressed in determining the hardware and software needs of most rehabilitation services agencies:

1. Basic office automation
2. Business/financial application
3. Service delivery/programs
4. Fund raising/development

Basic Office Automation Software

The highest volume automation need for most agencies is office automation, specifically word processing. Staff in all departments of your agency may benefit from word processing. A simple data base is also a must (a software system that allows you to file and retrieve information in selected fields).

Some agencies can use electronic mail, sharing messages among departments through their terminals.

Business graphics constitute another type of office automation software used by agencies interested in portraying statistical data in various graphic formats. Special printers are required for full graphic use.

In most medium-sized agencies, a terminal is used for office automation.

Business/Financial Application Software

The most-used software after word processing is an electronic spreadsheet (Multiplan, Visicalc, Supercalc, etc.). This special purpose data base provides a great tool for budgeting; it allows users to store and manage data with calculation, comparison, and percentage capabilities.

A well-automated fund accounting system is another key tool for the efficient financial operation of any agency, covering general ledger, accounts payable, accounts receivable, etc. Fund accounting systems should not be confused with cost accounting systems. Computer salespersons unfamiliar with specialized rehabilitation-related accounting procedures often try to sell cost accounting systems that do not meet the accounting practice standards recommended for your agency.

Payroll, clinic billing, job

costing and other accounting utilities software may be needed to meet your agency's financial needs.

Service Delivery Programs

Because this software must usually be custom built, available packages can be risky, poorly documented, and full of bugs (errors) or applications that will not work for your unique purpose. Systems that track and manage a full range of services offered to your clients should be considered in automating your agency. Look for software written by a known agency or programmer. Try to purchase a system written on a data base; every agency will need to customize software to meet its specific and singular needs (e.g., referral sources are not the same among agencies). Client information tracking and management software written on a data base will allow your agency to customize the data you enter and retrieve it, without hiring a programmer. Customized software written on a data base should allow you to design and generate reports that are unique to your agency's reporting systems. Custom client management software written in or as a data base allows custom report formats to be developed. Data bases, built into or interfaced with custom software, have the necessary power and depth to address your agency's unique reporting requirements. Another plus for data bases within custom software products is that data bases are relatively free of the errors, that arise in software developed specifically for your agency.

It is in the area of client information, tracking, and management that most agencies mistakenly purchase or have programmed unusable software costing as much as entire computer systems. BUYER BEWARE!

Fund Raising/Development

Rehabilitation agencies are increasingly called to generate outside revenues to meet their resource needs.

The market has a myriad of fund-raising software. High donor profiles, mail and donor list management systems, special events, planned giving, telethon, and neighbor-to-neighbor campaigns are all available.

Before considering specialized fund-raising software, look at a good word processor, a simple data base, and mail merge software.

These three inexpensive pieces of off-the-shelf software enable most agencies to handle most of their fund- raising activities. They don't need to be custom built.

A high-donor profile can be developed simply by selecting specific fields on a simple data base (name, age, friends, special interests, donor history, etc.)

By incorporating word processing and mail merge software, an agency can generate, inhouse, customized letters and mail lists for selected smaller groups of donors. Maintaining larger mail lists in house (over 5,000) is impractical for most agencies because of the amount of typing time and analysis (prospecting, merge/purge, updating, etc.) required.

Choose a fund-raising software system that has a successful use record. Ask others who use the system for their opinions. Beware of software salespersons claiming that their fund- raising systems will do all the things you desire.

Service bureaus or mail houses that specialize in sophisticated fund- raising programs now market products that can be run inhouse. Selecting software systems form established houses or bureaus assures technical expertise. You buy the experience and capability of data analysis for future planning and expansion of fund-raising activities.

In summary, agency directors attempting to automate their facilities must address all aspects of their business. They must willingly learn, use consultants, and strategically plan for computerization.

Automation takes twice as long to implement as to plan. The learning curve is steep for all staff and management.

The right equipment is essential before automation begins; the bruises from the fall may otherwise, be painful.

Custom Database Software for Rehabilitation Facilities

Following is an example of a customized data base that can be effectively used by most rehabilitation facilities known as the NSTAR Patient Management System.

NSTAR is an acronym that stands for:

National Easter Seal Society's
Storage,
Tracking,
Analysis, and
Reporting
Patient Management System

NSTAR is an example of a special purpose data base. A data base is a computerized tool that allows the storage and retrieval of information about various subjects in a number of ways. Typically, a computerized data base will allow rapid retrieval of stored information, searches for information on given topics, sorts arrangement of stored information, and the printing of reports. A special purpose data base is a computerized record keeping system dedicated to a single purpose.

NSTAR has been designed to assist in managing the information flow in any rehabilitation setting.

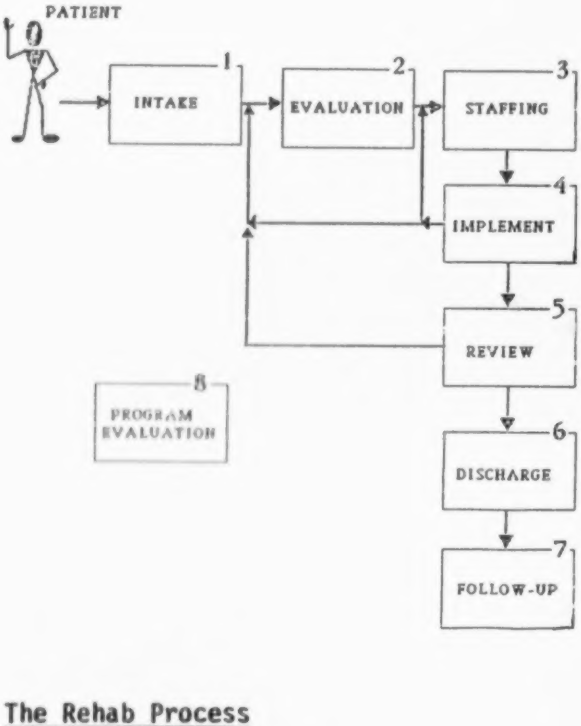
Great care has been taken to make this software quick, powerful, and easy to use. There are only fourteen quickly-mastered basic commands.

The data base is composed of a collection of records, one for each patient in the census. Information may be entered into each patient record at patient entry, and evaluation throughout the treatment period, and at discharge and follow-up. The information entered can be used to produce a large number of reports, all of which may be customized to specific needs.

In fact, almost every aspect of NSTAR may be customized to adjust the software to fit specific needs. This customization process is discussed throughout this document.

The rehabilitation process may be conceptualized as containing several steps, as illustrated in the accompanying figure. These steps include entry into the service system, intake, evaluation, interdisciplinary team staffing (program planning), program implementation, periodic program progress review, and subsequent discharge from service or re-entry into further evaluation and service. Throughout this process, and evaluation of the client program is also taking place.

THE REHABILITATION PROCESS



The Rehab Process

For our example, patient entry

into the service system occurs at the time of referral, either to a centralized referral bureau or to the rehabilitation agency. The service system includes the rehabilitation service agency, but also extends far beyond the scope of the agency to encompass generic service agencies and community resources. All of the services and resources in the service system cooperate in a coordinated fashion to address the needs of patients. Entry into the service delivery system acknowledges the person as a potential recipient of rehabilitation service(s), but does not necessarily guarantee admission into active services. A determination of the need for service and the propriety of the available service settings for meeting needs must be completed prior to admission. This determination is based on a set of admission criteria pertinent to the service agency's target service population. It is in the individual's best interest to minimize the period of time between referral and admission (or the determination that admission is not appropriate).

Intake

At the time of admission, the patient is involved in a set of INTAKE activities. These include all initial interviews and information collection tasks necessary to begin a comprehensive service file for the patient; this comprehensive file is known as a UNIT RECORD (or CASE RECORD). All information concerning the patient from entry through case closure is maintained in the unit record. It is a portion of this record that is maintained by NSTAR.

Evaluation

Following the intake, the patient is involved in a period of evaluation. Therapists and other examiners employ standardized testing instruments and procedures to determine the patient's current presenting rehabilitation problems during evaluation. This process is essential for establishing the areas in which rehabilitation services should be rendered. The evaluation may be of several types, such as etiological diagnosis, which seeks to determine the underlying causes of a rehabilitation problem or descriptive (behavioral) diagnosis, which seeks to determine the functional effects of a rehabilitation problem.

Staffing

After an evaluation has been completed, the patient, the staff of the agency, and (if necessary) the patient's family meet to discuss the findings of the intake and evaluation processes. Based on joint agreement, this group, know as an INTERDISCIPLINARY TEAM, constructs and INDIVIDUALIZED TREATMENT PLAN, a plan for services agreed upon by all concerned parties. This individual plan contains service objectives designed to address the diagnosed rehabilitation needs and pertinent supporting information, such as the projected length of treatment, parties responsible for rendering treatment, and methodologies to be employed. The process of constructing a plan may involve gathering opinions from specialists in several disciplines, such as speech therapy, audiology, physical therapy, occupational therapy, social work, psychology, work adjustment, vocational services, counseling, skilled nursing, and medical services. This team effort is called a STAFFING. Staffings may occur several times in the course of treatment; the team initiates, and then periodically reviews, the priority rehabilitation objectives.

Implementation and Review

Implementation of the objectives outlined in the individual plan is the responsibility of the therapists and paraprofessionals assigned during the staffing. Progress notes of patient (client) response to treatment (work experiences) must be maintained by the direct service staff and by the coordinating staff that supervise the rehabilitation process. Based on these daily notes, periodic progress reviews are made; the review can lead to subsequent modification of the individual plan by the team or by the team's designate.

Discharge and Follow-up

A client may, as the result of a progress review, be scheduled for implementation of new rehabilitation objectives, further evaluation, further discussion by staffings teams. Additionally, if all objectives for treatment have been substantially met, discharge from active service into a more appropriate environment can be made. Following discharge from active service, the patient/client progress in the new environment is measured periodically by a process known as FOLLOW-UP. Re-admission to the program, ongoing counseling and support, or other supporting actions may be used by the team, if necessary, to assure the patient's well-being. Ultimately, the patient/client will need no additional services. Independence from support is stated as a CASE CLOSURE.

Closure and Program Evaluation

Closure may occur because of complete (or substantial) rehabilitation of the patient (positive closure), or the inability of the service agency to further address the patient's rehabilitation problems in a costeffective manner. Certainly, positive closure is the overall goal of all rehabilitation services. The percentage of patient cases successfully concluded and the average length of time required to bring about positive closure are important statistical measures that can be used to determine a rehabilitation agency's efficiency and effectiveness of service delivery. The cost of services rendered per patient can be determined based on length of treatment. These and other measures are used as internal indicators of costeffectiveness and as marketing tools in the continuing search for additional funds from public and private sources. The derivation of these measures in view of the agency's overall objectives and the subsequent feedback of results to administration and service personnel are functions of PROGRAM EVALUATION.

Using NSTAR

The NSTAR Rehabilitation System includes mechanisms for collecting patient intake information, as well as evaluation, staffing, implementation and review, discharge, and follow-up information. Program evaluation, demographic analysis, and even applied research, are supported through the software's versatile data manipulation and reporting mechanisms.

NSTAR was designed and programmed by Jerry Bedwell, Associate, Technical Operations, Management Information Systems of the National Easter Seal Society.

Dr. Rita Glass, Director of Management Information Systems for the national Easter Seal Society, wrote the curriculum and assisted in the system design.

SELF-HELP GROUPS FOR THE DISABLED: PROFESSIONAL INVOLVEMENT

BRUCE F. PAMPERIN

ABSTRACT

This paper presents a model of professional involvement with self-help groups for disabled persons. A definition of self-help is offered. The professional, as a change agent, is defined in relation to four subsystems: (1) change agent system, (2) client system, (3) target system, and (4) action system. This model of practice is then related to four stages of problem solving: (1) assessment, (2) planning, (3) implementing, and (4) evaluation. The professional is defined as an expert in the problem solving process. A developmental model of transitions through which the disabled person passes is then outlined: (1) impact/affinity, (2) recoil/unity, and (3) accommodation/self-generation. Finally, two cautions about the relationship of the professional to the self-help movement are offered.

> An impossible situation prevails when we begin to think that any one group or groups of experts can solve all human problems. Mental health workers are bound to fail when they do not recognize their own limitations and when they try to maintain a superordinate position as the "helping expert." (Silverman, 1978)

Self help groups have come of age. They are changing the human services landscape and, yet, many human service professionals have little training or knowledge about the nature of self-help groups. There are many reasons for this lack of understanding. It is the purpose of this paper to provide human service professionals with a framework for starting self-help groups with client populations currently not served in their communities. Therefore, this paper is intended to lay out a model of self-help groups which are sponsored by a professional. It does not intend to discuss the philosophy or directly the advantages of self-help groups over more traditional professionally based methods of intervention with target populations. The reader is referred to a number of recent authors who have discussed at length the relationship between professional practice and self-help groups (Silverman: 1982, Gartner and Riessmann: 1984).

This paper is divided into four sections. First, a conceptual model is presented which identifies the four subsystems a professional works with while building a self-help group. This model operationalizes the systematic model of social work developed by

Pincus and Minahan (1973). The subsystems are as follows: (1) change agent system, (2) client system, (3) target system, and (4) action system.

Second, once the four subsystems are identified, the change agent and action system are prepared to start a problem solving process. The problem solving process developed here is divided into four tasks: (1) assessment, (2) planning, (3) implementing, and (4) evaluation. This model of problem solving directs the activities of the professional, emphasizes the four aspects that lead to a complete understanding of the problem, and helps to choose strategies that resolve the problem.

Third, after the professional has helped in the organization of the client group, the process of mutual support begins. In this section the developmental transitions that individuals pass through are discussed, using the framework identified by Silverman (1978). The three transitions are: (1) impact/affinity, (2) recoil/unity, and (3) accommodation/selfgeneration.

Fourth, in the final section, two issues about the relationship of the professional to the self-help group are examined. The professional must guard against becoming too successful and taking control of the group. Professional practice occurs within the context of bureaucratic regulation that values standardization and uniformity. These two traits can defeat a self-help group. When people join together to solve common problems, they work best when creative problem solving is encouraged and allowed to flourish. Standardization stifles creativity and spontaneity. Self-help groups can also become a substitute for needed professional services. At a time when social service programs are undergoing reexamination and budgets are being reduced, we must guard against creating quasi self-help groups that mask human suffering in the name of self-reliance.

First, let me define self-help group. Alfred Katz and Eugene Bender (1976) developed what I believe to be the most complete definition of self-help groups. In this paper, I include the role of the professional change agent for facilitating a self-help group.

Katz and Bender (1976:9) state:

> "Self-help groups are voluntary, small group structures for mutual aid and the accomplishment of a special purpose. They are usually formed by peers who have come together for mutual assistance in satisfying a common need, overcoming a common handicap or life-disrupting problem, and bringing about desired social and/or personal change. The initiators and members of such groups perceive that their needs are not, or cannot be, met by or through existing social institutions. Self-help groups emphasize face-to-face social interactions and the assumption of personal responsibility by members. They often provide material assistance, as well as emotional support, they are frequently "cause" oriented, and promulgate an ideology or values through which members may attain an enhanced sense of personal identity."

Four Subsystems of Self-Help Groups

Change Agent System

Pincus and Minahan (1973:63) define the change agent system as "The change agent and the people who are part of his agency or employing organization." Although the term change agent can refer to anyone involved in the change process, Pincus and Minahan limited it to individuals professionally employed. Therefore, the change agent system refers to the professional and the agency that employs him. The change agent represents the professional's knowledge, values and procedures for providing methods of planned change to an individual, group or community. Previous experiences help shape the change agent's orientation and approach in the problem solving process for clients requiring services. These experiences are substantially influenced by the values, history and mode of operation of the employing agency. Each agency has its own unique history and special mission. Disabled individuals are serviced by a wide variety of social service agencies, including mental health agencies, rehabilitation (both public and private), social service agencies providing home living opportunities, and other related services. Although each agency has a special function, none are identified as the principle agent for the development of self-help groups. Thus, the change agent refers to all professionals working with disabled persons irrespective of their professional training and employing agency. However, the change agent must be sensitive to prevailing values that influence and shape their agency. Only by careful planning will the change agent receive sanction and cooperation from superiors. The agency may provide valuable resources to the change agent including: meeting rooms, mailing lists, access to experts, and knowledge of client problems and strengths.

The Client System

Pincus and Minahan (1973:63) define the client system as "people who sanction or ask for the change agent's services, who are the expected beneficiaries of service, and who have a working agreement or contract with the change agent." A disabled client's system could include the following persons: The disabled person, family members, caregivers in a group or residential living facilities, other organizations attempting to provide alternative social services to the disabled population, or parents of such disabled as developmentally delayed persons.

After a change agent has been approached by a client group, a contract will need to be written that identifies roles, establishes goals, and develops criteria for evaluation. Early in the group is formation, the professional needs to guard against providing too much structure and consequently making the group dependent on his knowledge. One role of the self-help group professional is as an expert on the process of group dynamics.

The Target System

Pincus and Minahan (1973:63) define the target system as the "People who need to be changed to accomplish the goals of the change agent." Based on other attempts to establish self-help groups, we can not assume that all individuals interested in the disabled person support the establishment of the group. For example, a physician may have serious doubts about his patient's participation, believing that these groups are unnecessary or interfere with the overall medical plan for which he is responsible. In this situation, a strategy needs to be developed that obtains the cooperation of the reluctant physician. Providing articles or examples of physicians using self-help groups may encourage support.

In another example, a reluctant spouse may be overly protective of the disabled spouse. They might feel threatened by the group members or the group facilitator, fearing that they will be displaced and lose their role; perhaps a role that has provided them with ego satisfaction and a purpose in life. In this situation, a separate group may be established to provide support for the spouse. This is a proven and important component in the recovery strategies of alcoholic families.

The Action System

Pincus and Minahan (1973;63) define the action system as "The change agent and the people he works with and through to accomplish his goals and influence the target system." The professional should develop a team to meet the goals of the client system. In order to build a team, the professional prepares a list of influential people that can provide assistance in the establishment of a group. Action team members may include, but are not limited to, social service personnel who provide referrals, and physicians who help prepare a client for referral and identify them as part of the treatment process. News media, such as radio, TV and the newspapers, can be extremely helpful by making the public aware of the self-help group.

Problem Solving with the Four Systems

Once the four systems have been identified by the change agent, an overall conceptual framework of planned change needs to be designed. The problem solving process provides a framework of four stages. The stages are used to identify tasks. A linear or sequential ordering of the problem solving process is not assumed. The four stages overlap and can occur at more or less the same time. The four stages are: (1) assessment, (2) planning, (3) implementing, and (4) evaluation. However, for the purposes of clarity, the stages are defined as separate tasks. A brief summary of these tasks follows:

Assessment

Assessment refers to the collection of data about a problem that a population is undergoing. An assessment includes a listing of potential strengths and current weaknesses in the disabled person's environment. Potential sources of information for the assessment include the disabled person, social service professionals, family members, medical professionals, clergy, volunteers, scientific literature, and other experts.

Conducting an assessment is a difficult activity. The most important principle to remember is to keep an open mind. Far too often assessments are limited by the theoretical framework in which a professional has been trained, such as client centered or psychodynamic. Frequently, a single theoretical framework determines the outcome of the assessment. The problem should determine the most appropriate methodological solution. In assessment stage, a clear definition of the problem develops and a statement of how group membership can alleviate problems and enhance coping skills through mutual support is defined. Frequently, the definition includes a coordination role for professionally based services.

Planning

Once a problem statement has been developed a plan of action may be created. The planning process should include members of the action system. A detailed plan of what is to be done by the various individuals is developed in this stage. Such items as where the group will meet, how new members will be recruited, what the focus of meeting will be.

Meetings may be planned around group discussions of spontaneous topics, talks given by "experts," the sharing of common problems each face or the sharing of how others cope with similar problems. The self-help group should emphasize the members wants and needs and not mimic existing programs developed for other populations. A written plan may be useful in recording the decisions made.

Implementing

After the plan has been developed, it is implemented. Carrying out the plan starts the process of self-help. During the implementation of the plan, the observant professional identifies potential leaders who will replace him when the group is sufficiently self directive. The plan may need some modification during its implementation. Dates, times, and locations may need to be altered in order to conform with members' schedules. The implementation stage is a time when evaluation is also conducted. This brings us to the next stage, evaluation.

Evaluation

Evaluation is divided into two types; formative and summative. Formative evaluation is conducted for the purpose of improving the group as it develops. For example, the meeting times may be altered because of conflicts with other meetings or responsibilities. The professional may have spotted a member who dominated the first few sessions and will need to help that individual recognize their impact on the group and learn more appropriate behavior. Formative evaluation may also involve the resolution of interpersonal conflict or the provision of structured learning experiences on group dynamics in order to learn more about group relations. Formative evaluation provides feedback to the group so corrections may be made as they learn how to give and receive support from one another.

Summative evaluation pertains to the overall worth or success of the group. It also refers to the evaluation completed at the end of the group project. Important questions include: Did the group learn to maintain itself? Were new members accepted into the group? Did the members benefit from the group experience? This is only a partial listing of potential questions that would be asked for a summative evaluation.

The Three Stages of Transition

Silverman (1978) has developed an integrated model of the developmental transitions self-help group participant pass through. Silverman's model has three components: (1) impact/affinity, (2) recoil/unity, and (3) accommodation/self-generation. These developmental transitions are presented and discussed below:

Impact/Affinity

Impact/Affinity is the first transition in the individual's adjustment to disability and membership in a self-help group. First, the individual experiences the shock of having a disability. This role status change is frequently abrupt; new ways of coping with life are required. Because of the new status as a disabled individual, previous socialization experiences become inadequate; this results in the need for resocialization to understand newly imposed limitations and to avoid any tendency toward learned helplessness.

The self-help group develops an affinity between the newly disabled and others who have been disabled for some time. Recognization that they are not the only person with this particular problem and seeing others who are able to cope with the problem provides role models for the new member. Experienced group members provide support and encouragement. The new member is encouraged to discuss their feelings and problems with others who know first hand about the shock of being suddenly disabled. Experienced members "teach them the ropes."

This stage of developmental transition is first marked by a feeling of aloneness that is replaced by a feeling of group belonging. The aloneness is exchanged for a sense of hope. New friends and allies provide enjoyment and companionship while learning to adjust.

Recoil/Unity

During recoil/unity transition the new member spends much of his time learning about his new status. Information about his disability is presented and experienced individuals share how they have coped and offer advice. This period of resolution is a full immersion into the culture of disabled persons. Language, jokes, dress, and other symbols of the culture are internalized and become accepted as part of a new identity. The self-help group functions as a primary resocialization group designed to support the individual through mutual interaction. It helps the individual regain their confidence.

Accommodation/Self-Generation

Accommodation occurs when the individual begins to achieve veteran status with the other members. The shock of their disability is placed in perspective; they begin to see that others may need their help, just as they were helped. The group provides moral support and reassurance. The main task for the individual is to fit pieces of their previous lifestyle with their current lifestyle. The original shattering experience is left behind and a new whole identity is created.

Self-generation may include role reversals, from help seeker to helper. Not all members choose this status, but for some it provides great satisfaction and rewards, and it insures continuance of the group. The group also needs to remain open, allowing members to leave when they are ready. Self-help groups must guard against being paternalistic and prepare the individual for the community. A schematic representation of this model is found in below.

Limitations of Professional Involvement

Self-help groups sponsored by professionals can extend professional and agency bureaucratic tendencies toward standardization. The strength of the self-help movement lies not in professional superordination and control but in the control placed with the group members. This issue of control is similar to the teacher-student relationship. The teacher can easily dominate and influence the student but must not, otherwise the student fails to learn what the teacher has to offer-freedom; the freedom to create and act as an individual fully capable of making informed choices. If the professional becomes too responsible the group will not be able to grow and nurture the members who seek understanding and comfort. The professional relationship to the self-help group should be much like that of the gardener providing a fertile environment for the creative process to flourish and take hold.

A second warning is offered. Current national policies toward disabled persons are being reexamined. Old value assumptions about the government's involvement in assisting the disabled are being questioned. While serious questioning is always healthy, the current questioning is premised on the reduction of government involvement and, therefore, expenditure. Now, as the family is being called upon to take more responsibility, the self-help group could be called upon to supplant more traditional social services. At stake is the overall quality of life for some of our most vulnerable citizens. Self-help groups cannot become alternatives to professionally based services when there is a need for these services.

Summary

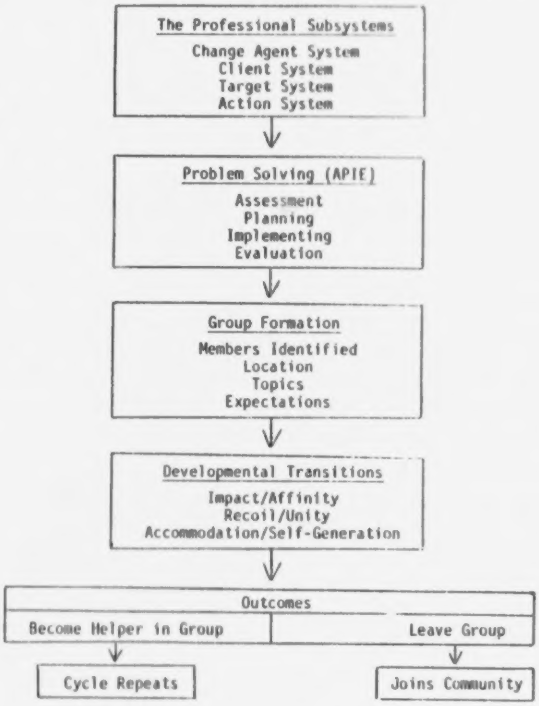
The future of self-help groups for disabled persons rests, in large part, upon the skill of the professionals that help create these alternative, nonprofessional models of self-help and mutual support. In this paper, a working model of professional involvement was outlined. The professional's role was defined relative to four subsystems: his agency, the client population, persons to be changed, and the team created to establish the group. The problem solving process was offered as a framework for determining which task to work on when trying to establish the group. The four problem solving tasks are: assessment, planning, implementing, and evaluation.

The disabled person's relationship to the group was defined in terms of the developmental transitions that typical individuals are likely to pass through. These transitions mark the individual's adjustment growth. The transition periods are: initial shock, learning to cope, and the integration of their new lifestyle.

The limitations of self-help groups sponsored by professionals have serious implications for both their eventual independent functioning and overall role in the disabled person's life. Professionals should avoid taking too much responsibility in the creation of the group. Fostering dependence will eventually lead to bureaucratic domination and, thus, the corruption of the nature of self-help groups.

Finally, self-help groups cannot substitute for professional services when they are required. These groups serve a unique and much needed purpose, but they should not become substitute services to support budget cutbacks.

SCHEMATIC DIAGRAM FOR STARTING A SELF-HELP GROUP


The Professional Subsystems
Change Agent System
Client System
Target System
Action System
Problem Solving (APIE)
Assessment
Planning
Implementing
Evaluation
Group Formation
Members Identified
Location
Topics
Expectations
Developmental Transitions
Impact/Affinity
Recoil/Unity
Accommodation/Self-Generation
Outcomes
Become Helper in Group
Leave Group
Cycle Repeats
Joins Community

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BRIDGING THE TECHNOLOGICAL GAP

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ABSTRACT

The policy of deinstitutionalization of the mentally ill coupled with the dawning of the age of technology has exacerbated the historical difficulties faced by vocational rehabilitation programs in successfully providing employment for their clients. The traditional gaps between the functioning level of the client and the demands of the mainstream employer have, consequently, widened. The "Bridging the Technological Gap" Project (BTG), a three year demonstration project funded by the U.S. Department of Education, Rehabilitation Services Administration, aims to use microcomputer technology in the rehabilitation of the psychiatrically disabled. Through the use of a custom designed microcomputer software package, clients receive remediation in areas of specific cognitive deficits. The addition of this approach to traditional rehabilitation efforts is intended to increase the employability of the mentally ill.

The Crisis in Vocational Rehabilitation for the Psychiatrically Disabled

For the past several years there have been significant advances in the field of computer technology, particularly with the introduction of the microcomputer. The result of these advances has been the creation of a shift in the types of employment opportunities available in post-industrial nations, such as the United States. While jobs were once plentiful in unskilled and semiskilled labor-intensive industrial work sites, changing conditions have decreased these opportunities while employment openings in technological and service oriented fields have increased (New York Times 1983; Labor Market Information Network, 1982).

This shift in job opportunities has had a profound effect on the psychiatrically disabled. Often the work experiences they have received in vocational training programs and sheltered workshops have been geared to an industrial/manufacturing environment. Once it was sufficient to learn repetitive industrial assembly work, manual filing or typing; now, the new worker demands require the ability to operate a microcomputer, perform word processing, data entry, and/or automated record and bookkeeping. In addition, employers are increasingly demanding that personnel be flexible and adaptable, use independent judgement and be ready to continue learning during the course of employment. (National Institute of Handicapped Research, Dept. of HEW, 1976); Griffiths, 1974; Rehabilitation Services Administration, 1979).

The impact of these labor market trends has been hightened by the movement of persons with chronic disabilities into vocational rehabilitation as a result of public deinstitutionalization policies. These individuals have been characterized as apathetic, dependent, rigid, lacking in initiative, and tending to avoid new experiences. When considered in the context of the current labor market trends, these behaviors, are antithetical to those being sought by employers. Thus, attempts to increase the employability of these individuals should go beyond the updating of skill training and address these basic functional deficits.

Bridging the Technological Gap

Altro, in response to this need, proposes to improve the basic cognitive functions currently in demand in the labor market, but deficient in the mentally ill. The primary tool to be used in this effort is the computer. The introduction of the microcomputer into the treatment regimen represents an innovative attempt to integrate a powerful new technology into the field of psychiatric rehabilitation. The microcomputer is ideally suited in many ways to the task. It has been called "user friendly" because it can be easily accessed and tailored to the needs of individual users. In addition, micros can be programmed to not hurry the user by moving at the users work pace. It can also provide immediate feedback in a non-judgmental, stimulating manner. The attributes of this technology may well extend the powers of the individual interacting with it, particularly in the areas of intellect, ego function and cognition. (Chartrand and Williams, 1982); Imprint Software, 1982; Anastasin and Wang, 1981; Robleyar, 1981).

Altro's "BTG" project tests this premise by remediating basic cognitive and behavioral deficits through the use of the microcomputer and custom design software. The project will test the hypothesis that specific attention to these deficits and traditional rehabilitation will not only improve functioning in the targeted areas but will also enhance employability.

Specifically, the project will:

1. Create microcomputer software-applications that will focus on building flexibility, impulse control, attention and concentration, mastery competence, and problem solving ability.
2. Provide vocational training in fields requiring microcomputer skill, such as data entry, word processing, and bookkeeping.

The efficacy of this new approach will be determined via a rigorous evaluation effort that assesses the impact of the cognitive enhancement package and skills training individually and as used together.

Project Progress

As the project approaches the end of its first year, software packages have been developed and are currently being pretested for "fine-tuning." The project hardware, ten Apple Macintosh microcomputers, have been purchased. These machine are described as third generation computers. They have simplified user interaction by making use of simplified command structures (Mace, 1984).

Needs Assessment

Needs Assessment took a two-pronged approach; a review of existing software in use in rehabilitation and/or education, and an in depth analysis of the cognitive/behavior deficits within the Altro population.

Altro surveyed the progress made over the past several years in the use of microcomputers as an interactive learning device with learning and physically disabled children in the field of education. In addition, the use of microcomputers as a rehabilitative tool with adults who have lost cognitive functioning as a result of head injury was examined. Microcomputer software available for these populations are as diverse as the population. However, one of the common concepts in all of these applications is that microcomputer software enables individuals to initiate activities that can change an individual's environment, and in turn, the individual is effected by that environment. This principle was to be central to the software development. (Papert, 1975; Papert, 1980; Gable, 1980; Weir, 1982; Hannaford, 1981; Weizenbaum, 1976; Gianutsos, 1982).

Concurrently, a pilot study was conducted to identify the specific ego/cognitive areas in which Altro clients, with their often severe/chronic psychiatric disabilities, have problems. The Bellak Ego Function Scale was used as a primary tool for targeting the areas of greatest deficit among Altro clients. Ego Functioning as identified through the Bellak Scale has been found to be predictive of employability among the psychiatrically disabled. Measures were also obtained from WAIS scores and from the behavioral observations and evaluation of Altro's clinical and workshop stuff. (Bellak, Hurrich & Geidman, 1973; Ciaridiello and Sobkowski, 1983).

Cognitive deficits among the psychiatrically disabled were identified using the findings of the pilot. The areas identified by the Bellak Scale that showed the greatest functional impairment, and appeared most amenable to remediation through use of the microcomputer, were Adaptive Regression in the Service of the Ego (ARISE), Drive Regulation and Control, and Mastery Competency. Staff ratings and the Picture Completion subscore on the WAIS indicated that attention, concentration and memory were other deficits in need of remediation.

The existing software was examined in relation to identified needs. It became apparent that no available program would meet the particular needs of Altro clients. Therefore, it was decided that custom software should be developed using the principles of existing materials. Four software modules were developed. One corresponded to each of the deficit areas identified above. This series of software modules is called COGITO.

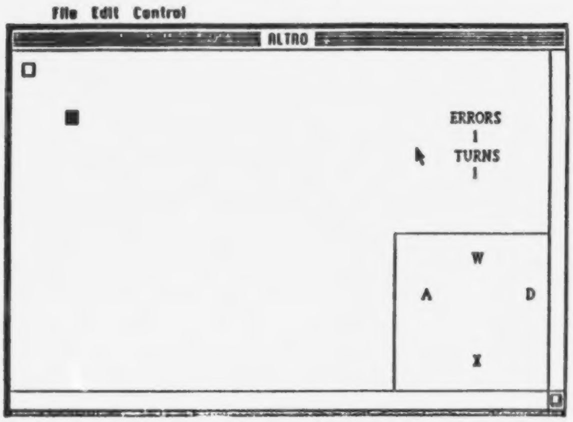
Software Development

The first module to be developed for COGITO was designed for ARISE. ARISE has been defined as the "capacity to relinguish well-formed secondary processes to allow for the creative utilization of more primative modes of thinking." It is associated with the functions of flexibility and adaptation. The software module contains training tasks that require the user to switch response sets. It also requires graduated adaptations to different response sets (Norello, 1974, p. 52).

The first component of the ARISE module provides a good example of COGITO software. It requires the user to move one box over a second box using special keys on the keyboard (such as a sequence of S,F,E,X, that moves the box up and down and left and right). A legend in the monitor corner indicates what movement each key provides. At set intervals the legend changes requiring the player to switch to a different set of letters to move the box. When the client does not switch to the new keys, an error is recorded. (See Figure 1).

The second domain, Drive Regulation and Control or Impulse Control is described as "the capacity to appropriately control the expression of drive derivitives: the degree to which aroused drives affect behavior." The module for this area contains two components. First the user must respond repeatedly to a stimuli and then inhibit that response relative to a cue. The second focuses on inhibiting a user's response and then responding appropriately to a cue. (Norello, 1974, p. 51).

Figure 1



The third area targeted for intervention, Mastery Competence, is "capacity for successful planning and mastery over environment." The user must learn to adapt to the demands of a computer constructed environment. Mastery is related to the client's ability to follow directions, manage resources, and attain goals. (Norello, 1974, p. 55)

The final module was developed for Attention, Concentration and Memory. This area is defined for this project, as the ability to discriminate between similar cues, remain on task, increase the amount of time on task and resist fatigue on task. This module requires the user to correctly discriminate pairs of pictures. This becomes more difficult in a second version when the user has to discriminate between pairs of pictures with a visual and/or auditory distractor present and with varying amounts of response time allowed. In a third version, the user is required to match picture pairs distributed at random in a four by four array from memory. This version is made more difficult by again adding an auditory distractor.

Altro is presently in the process of pilot testing and refining the software for the four described domains. In addition, it is investigating other areas of possible intervention with software applications.

Program Evaluation

The evaluation of the Bridging the Technological Gap program will be conducted under the auspices of the Altro Institute for Rehabilitation Studies, an autonomous arm of the agency that conducts educational, research, and evaluation projects.

The primary purpose of the evaluation is to test the hypothesis that the critical factor in the rehabilitation of severely disabled mentally ill persons is the remediation of basic cognitive and behavioral deficits. The assumption is that specific attention to these deficits together with traditional rehabilitation will not only improve functioning in these specific areas but will also enhance employability. The secondary hypothesis to be tested is that in cognitive/behavioral remediation will be most effective together with microcomputer skills training.

The specific experimental hypotheses are as follows:

1. The computer remediation program using "COGITO" will significantly improve: Flexibility/adaptability, impulse control, mastery competence and memory, attention, and concentration.
2. Clients participating in the computer remediation program using "COGITO" will significantly improve vocational functioning; specifically work appropriate behavior, productivity, and placement into competitive employment.
3. The computer remediation program using "COGITO" will be effective when used in conjunction with a microcomputer skills training program.

Subjects

The Project population will consist of Altro Health & Rehabilitation clients meeting the following criteria:

1. Minimum of an 8th grade reading level;

2. Minimum WAIS Full Scale IQ of 85;
3. Adequate finger dexterity to operate a computer keyboard;
4. Willingness to use the microcomputer.

Sample - Eligible clients will be randomly assigned to one of the following four experimental groups:

	COGITO	MICRO TRAINING	TRADITIONAL REHABILITATION
GROUP A	X	X	X
GROUP B		X	X
GROUP C	X		X
GROUP D			X

Each group will have 10 subjects. Subjects are projected to remain in the program for a maximum of 9 months.

Method

All subjects will be given the project test battery prior to entry into the program. The test will be repeated after four and one half months and after nine months. If a subject completes the program prior to nine month, post-test measures will be taken at that point. The length of stay will be accounted for in the analysis. A three month period following the training cycle will be allowed for placement into employment.

Instrumentation

Measures of program effectiveness will be made at three levels. Level I will measure performance on computer tasks. This will have built-in scoring mechanisms. Level II will use validated psychometric instruments that correspond directly to each of the program modules to test the generalization of acquired skills. Level III will test generalization to broader areas of functioning including work related behavior, productivity, program attendance, self esteem, and symptomatology encapsulation.

Analysis

Each hypothesis will be tested via a multiple analysis of variance that assesses the significance of change over the course of the project. The interrelationship between the levels of measurement will be established via an analysis of covariance.

Client training in the "BTG" Project begins November 15, 1984. For further information contact:

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Demonstration Project support is provided by the United States Department of Education, Rehabilitation Services Administration, Washington, D.C.

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BIOFEEDBACK TRAINING AS A FACTOR IN THE PERSONAL/VOCATIONAL ADJUSTMENT OF REHABILITATION STUDENTS

JOHN D. SEE

ABSTRACT

This pilot project was designed to compare the effects of two types of biofeedback training on the personal/vocational adjustment of rehabilitation students.

Thirty-three volunteer students were randomly assigned to three experimental groups: 1) EMG biofeedback, 2) Thermal biofeedback, and 3) Control. The two treatment groups received ten weeks of standardized biofeedback training.

The outcome criteria were post-test scores on the POMS (Profile of Mood State), the Internal External Locus of Control Scale, and the Vocational Maturity Scale.

The results of this study showed that those students who received biofeedback were significantly (.05 level) less depressed and confused, as measured by the POMS, than were their counterparts in the control group. These results, however, must be seriously questioned in light of the high drop-out rate of the volunteer subjects (27%).

This paper reports the first phase of a pilot project in biofeedback training which began at the University of Wisconsin Stout in the spring of 1984.

The initial findings derived from a ten week study of the use of biofeedback training as a factor in the personal/vocational adjustment of graduate and undergraduate rehabilitation students at UW-Stout.

Background

Research evidence strongly suggests that biofeedback training may have a valid role in non-medical settings such as rehabilitation facilities, correctional programs, or wellness projects in industry, and yet there has been very little comprehensive research done in this area.

Biofeedback in its simplest form (muscle relaxation or thermal training) has been shown to have a salutary effect on a wide variety of emotional conditions which interfer with normal functioning. The following list is a sample of client conditions seen in rehabilitation settings which might be helped by biofeedback training:

- general anxiety and tension
- adult situational reactions (the recently disabled)
- adolescent situational reactions (troubled teenagers)
- phobic reactions to specific situations (test taking, job interviews, etc.)
- poor motivation or lack of interest
- problem drinking or chemical abuse
- lack of concentration
- rebelliousness or hostility
- withdrawal
- fear of failure
- lack of assertiveness

A common finding in the literature is that clients who successfully engage in biofeedback training often experience an increase in self-awareness and a heightened appreciation of the control they have over their own destinies. They are described as showing more self-confidence, increased motivational levels, and a stronger commitment to "act" on the environment rather than to be victimized by it.

If this observation proves correct for rehabilitation clients, we might expect to see an improvement in their capacity to participate in, and profit from, the rehabilitation process if biofeedback as training is provided.

In this project, biofeedback is conceptualized as a standardized wellness component that can be instituted in various rehabilitation settings using moderately priced equipment operated by minimally trained professional staff. It is important to stress that the use of biofeedback in this project differs substantially from that provided in a biofeedback clinic where clients are treated for medical or psychological problems requiring careful diagnosis and individual treatment. This research deals only with the types of biofeedback that are well established and for which there are essentially no medical contra-indications; i.e., thermal training and electromyography (EMG) training for individuals without organically-based medical problems.

Purpose of Study

The specific purpose of this study was to investigate the relationship, if any, between a packaged ten week treatment program in biofeedback and changes in personal/vocational adjustment of the subjects as measured by post-test scores on a battery of psychometric instruments. The thirty-three subjects were randomly assigned to a control group, a treatment group that received only EMG training, and a treatment group that received only thermal training.

Literature Review

The biofeedback literature is not conclusive regarding the relative merits of EMG and thermal training in the treatment of stress or anxiety.

In their summary of the biofeedback field, Katkin and Goldband (1980) state that EMG and EEG (brain waves) are the two fundamental approaches to the treatment of anxiety. This prevailing sentiment seems to be illustrated by Zimberg (1980) in his discussion of alcoholism, when he state that:

> "EMG biofeedback has been found to be the most useful for anxiety reduction. It is not useful in the treatment of actively drinking alcoholics but can be helpful in post withdrawal where there is often prolonged neurophysiological hyperactivity of the central nervous system and increased muscular tension along with the feeling of anxiety."

Still many experts in the field of biofeedback see thermal training as a viable means of inducing relaxation and combating psychological tensions.

Barbara Brown (1977) in Stress and the Art of Biofeedback states:

> "There are two principle biofeedback procedures whose primary focus is stress reduction. These are muscle (EMG) biofeedback to assist in learning muscle relaxation and temperature biofeedback, which produces more internal relaxation effect."

She goes on to state that:

> "Temperature training for relaxation effects is generally performed using hand or finger temperature. There has been no solid physiological evidence that temperature biofeedback results in a general relaxation effect, but a particular type of internal relaxation effect is inferred to occur from the subjective reports following training and from the relief of pain in tension and migraine headaches."

Gaarder and Montgomery (1977) state:

"...there are a growing number

> of clinicians who have developed partiality toward the general use of finger temperature feedback as a general method for the treatment of stress related syndromes and who may not use other modalities as a result. Their good results seem to validate their taking this position, although thorough comparative studies are not yet available.

Daskin and Crow (1981) cite a study where thermal training was used as a part of a rehabilitation program for prisoners. The experimenter "felt that the prisoners' success in thermal training was accompanied by an increased sense of self-mastery which permitted a more honest and open exploration of ideas designed to bring about changes in self image."

The abstract of Elmer Green's paper (1974) on the use of biofeedback in the treatment of alcoholism and drug addiction states:

> "A voluntary biofeedback program is described which includes training in temperature control and relaxation meditation. It is concluded that, aided by biofeedback, a person can learn to modify emotional reactions so that continuous psychological stress will not perpetuate chronic somatic distortion."

The potential of Thermal training suggested by the above authors corresponds closely with the clinical opinion of the staff of the Biofeedback Laboratory at the University of Wisconsin-Stout. (Personal Communication). They have used thermal training with considerable success in the treatment of stress related emotional disorders in college students.

So, while EMG appears to be the treatment of choice for anxiety reduction at this time, the empirical underpinning is not strong and it would be premature to discount other biofeedback modes such as thermal training. This is especially true as thermal equipment is generally less expensive than EMG or EEG equipment and is easier to maintain and operate.

Methodology

Subjects

Vocational rehabilitation students were invited to participate as subjects in the biofeedback research. The purpose and nature of the research was explained to them. Those who volunteered to take part signed a consent form and were randomly assigned to one of three groups: EMG, thermal, or the control group. Those in the treatment groups were scheduled to receive 10 individualized biofeedback sessions (one per week) conducted by student biofeedback technicians from the University of Wisconsin-Stout Biofeedback Lab. There were eleven subjects in each of the three groups.

Equipment

The EMG instrument was a Cyborg J33 Muscle Trainer. The thermal instrument was a Cyborg J42 Feedback Thermometer.

Procedure

The actual biofeedback sessions followed a standardized format. The initial session was primarily diagnostic and educational. The technician collected biographical and medical data on the client, gave an explanation of the general procedures to be followed, and introduced the client to the equipment. A trial "hook-up" took place during which a baseline measurement was recorded. It is frequently desirable at the beginning stage to give a brief explanation of the autonomic nervous system and how biofeedback can teach people to consciously control bodily responses which were previously thought to be unconscious or reflexive. It is essential that the client see the connection between biofeedback training and stress reduction. They need to appreciate that the self-control they develop in biofeedback will provide them with a new skill for coping with the tensions and anxieties of daily living.

It was also during the initial session that the client was introduced to the concept of daily home relaxation practice. Systematic relaxation or autogenic training is an integral part of virtually all biofeedback programs for anxiety reduction. The technician explained the importance of home practice and attempted to get a commitment from the client to conscientiously practice daily for the next ten weeks. The clients were given cassette tapes which guided them through the systematic relaxation sequence. They were also allowed to check out portable tape recorders if necessary.

The remaining biofeedback training sessions followed a standardized format. These sessions were approximately 30 to 45 minutes in duration. The client was greeted, blood pressure and pulse rate were checked, and there was a discussion about the progress being made with the home practice. The thermistors or electrodes were then attached and with the client in a sitting or reclining position, the biofeedback signal was presented. The technicians were well trained in the clinical strategies that assist clients to reach successively deeper levels of relaxation. Client progress was charted for each of the remaining nine training sessions.

Dependent Variables

At the end of the ten week program each client took the following psychometric tests: 1) Profile of Mood States (POMS), 2) Rotter's Internal-External Locus of Control Scale, and 3) The Career Maturity Inventory-Attitude Scale.

These instruments were chosen because of their face validity and logical relationship to personal/vocational adjustment.

Statistical Analysis

The hypothesis to be tested and the statistical analysis are as follows:

Hypothesis #1. There will be no significant difference between subjects of the three groups relative to personal/vocational adjustment.

This hypothesis will be analyzed using a three group ANOVA design. The groups will be compared on each of the three criteria of client gain (scores on the POMS, scores on the Locus of Control, and scores on Vocational Maturity).

Results

A major limitation of this study was the high drop-out rate and/or lack of compliance of the volunteer subjects. Of the original twenty-two subjects assigned to the two treatment groups, six (27%) withdrew. The participation rate of the remaining sixteen treatment subjects varied from four to ten sessions, with an average participation of 6.5 sessions. Because of the drop in the sample size it was decided to combine the EMG and Thermal groups into one treatment group which would then be compared to the control group. It was also decided to double the size of the control group in order to increase the power of the statistical analysis. This was accomplished by randomly picking eleven more subjects from an existing pool of volunteer students who had taken the same battery of tests under similar circumstances. Their scores were compared to those of the eleven subjects in the control group. No significant differences were found between the two groups on any of the outcome measures, so they were combined to create a control group with an N of 22. The analysis then became a series of t tests comparing the treatment group of 16 subjects with the control group of 22 subjects.

The results of this analysis is shown in Table 1. Significant differences were found on two scales of the POMS. Both the Depression-Dejection Scale and the Confusion-Bewilderment Scale were significantly lower (.05 level) for the treatment group. There were no other significant differences found on the POMS scales, nor were there significant differences found on the Locus of Control Scale or the Vocational Maturity Scale.

Table 1

Dependent Variables	Group #1 EMG and Thermal Subjects Combined (N = 16)	Group #2 Control Group Subjects (N = 22)
A. Profile of Mood States (POMS)		
1. Tension-Anxiety t = .166 (non sig)	$\bar{X}$ = 13.38 S = 6.01	$\bar{X}$ = 13.00 S = 7.16
2. Depression-Dejection t = -1.841 (sig at .05 level)	$\bar{X}$ = 7.25 S = 6.18	$\bar{X}$ = 12.86 S = 10.64
3. Anger-Hostility t = -.544 (non sig)	$\bar{X}$ = 7.69 S = 5.72	$\bar{X}$ = 9.18 S = 9.51
4. Vigor-Activity t = 1.103 (non sig)	$\bar{X}$ = 18.00 S = 6.56	$\bar{X}$ = 15.64 S = 6.19
5. Fatigue-Inertia t = .32 (non sig)	$\bar{X}$ = 10.38 S = 6.42	$\bar{X}$ = 9.73 S = 5.66
6. Confusion-Bewilderment t = -1.769 (sig at .05 level)	$\bar{X}$ = 6.69 S = 2.78	$\bar{X}$ = 9.27 S = 5.17
B. Internal-External Locus of Control Scale	$\bar{X}$ = 8.50 (statistical test not indicated)	$\bar{X}$ = 8.54
C. Career Maturity Inventory-Attitude Scale	$\bar{X}$ = 40.53 (statistical test not indicated)	$\bar{X}$ = 41.00

Summary and Conclusion

The results of this study suggest that those students who received biofeedback training were significantly less depressed and confused, as defined by the POMS, than were the students in the control group. This finding, however, must be seriously questioned in light of the high drop-out rate of the volunteer subjects.

One practical implication of this study is that it emphasizes the very real difficulty of keeping clients motivated to continue with their biofeedback training once the novelty has worn off. The subjects in this study who had the higher levels of participation tended to be female graduate students assigned to the EMG treatment group.

A replication study is currently being conducted at UW-Stout in which college credit and grade are contingent upon the level of participation.

It seems that, for some, biofeedback is not its own reward.

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A STUDY IN CONVERSATIONAL PROTOCOL BETWEEN COMMUNICATION AID USERS AND NON-USERS

JAMES R. BROOKS

ABSTRACT

Problems in the communication interaction between communication aid users and nonusers are discussed in this paper. The extent to which understanding and meaning are exchanged and how well turn taking is accomplished are explored. For 23 years the author could not communicate with the spoken word. Communication enhancement has changed his world.

I am going to address some of the problems in the communication interaction between communication aid users and non-users. I think it will have important implications on the refinement of new systems. The main purpose of communication aids, as I see it, is to integrate non-verbal people into our society. A society which places great emphasis on the spoken word.

In interactions, we look at the extent to which understanding and meaning are exchanged and how well turn taking is accomplished. Turn taking involves speaking in turn. If one person is addressed directly that person should respond before any further interaction proceeds. These are some of the problems communication aid users encounter in interacting with others.

Principally people do not understand how communication aids work. After they understand, they will wait for their turn to interact. Sometimes they talk about a communication aid user, but not with the user, and in simpler terms. Turn taking is a problem at times. It takes a relatively long time. Some people ask new questions while the communication aid user is trying to answer their first question. This results in an inappropriate response. Also, people tend to speak slower and louder when talking to a non-verbal person, probably thinking a communication aid user has trouble hearing too.

Communication aid users shorten their responses to facilitate turn taking and to speed up conversations. It is assumed that if someone has one handicap he must have others; it is safer to assume this is true than it is not.

Because it takes communication

aid users longer to encode a response, sometimes users don't initiate conversations. This is because users are too busy catching up on questions generated when people do not understand a communication aide user's response. They sometimes ask others to clarify the response rather than the communication aid users themselves.

Turn taking, which is so fundamental to communication, is a problem which I and other communication aid users most frequently encounter. It would be nice if communication aids had a signal that would tell people to wait while we finish our preparation, just as speakers say "Wait a minute, I'm thinking." That would allow us to finish our train of thought and keep them from asking new questions before we are finished with their first question.

It is a matter of education about communication aids for the non-user. Education may also answer the problem of people assuming that if a person has one handicap they must have others. I believe that education will best come from integration of handicapped persons into all levels and areas of our society.

The communications technology is superb today and it will only get better. What is needed now is public understanding and acceptance of communication aids and their users. In order to accomplish this, more study of the interaction between users and non-users needs to be completed. Both parties must be willing to make modifications and accommodations in order to achieve the fundamental goal of communication, the exchange of meaning, ideas, and feelings.

I have a vested interest in this area. For 23 years I could not communicate in the socially acceptable way, the spoken word. People who cannot communicate through speech are cast aside by their peers. That hurts. Isn't it sad that we place so much emphasis on the ability to command the language?

Now that I can talk, a whole new world has opened up for me. It is wonderful. I am now accepted by our society just as other people; that is the way it should be. Remember, I said it is wonderful for me, it truly is, but the memory of how it felt before I could talk is, and always will be, with me. That is one of the main reasons I have dedicated my life to communication enhancement.

Today, it is totally unnecessary for anyone experiencing a speech handicap to go through the awful experience of being left out of social activities. I honestly believe that speech is a gift. Those of us who have that gift have the awesome responsibility of speaking up for our friends who still need communication aids. If even one person does not have a communication aid, that is one too many.

THE STATE OF THE ART OF HIGH TECH AIDS

MARY E. BRADY

ABSTRACT

This paper describes current problems in high technology aid design and application, and currently available, practical strategies to address these problems. It also raises questions to help you find possible solutions. The Author's goal is to "de-bunk" some of the "hype" of technology without lessening the hope offered by high-technology aids.

When Barry Rodgers and I discussed doing this presentation several months ago, we tried to think of a topic that would be timely and worthwhile to you, and would draw from our work at the Trace Center in a way that would convey the direction of our research and development projects rather than just a description of current activities. We got to talking about the needs of the field, and the role that a federally-funded center plays in meeting those needs. Therefore, I will be talking about the current state of the art in applying technology to communication.

I will be describing what I see as some of the current problems in high technology aid design and application, and some currently available, practical strategies to address these problems. I will also be raising questions and challenging you to help come up with some possible solutions. What I will be talking about is far from ideal yet it represents great progress and some tantalizing opportunities. My goal is to de-bunk some of the hype in this area without deflating any of the hope offered by high-technology aids.

My intention in the first part of this presentation is to detail some of the rather well-known but seldom discussed features of various electronic communication aids. I will spend a fair amount of time first, defining the terms I'll be using, because I feel that one of the biggest problems we have in communicating about the whole area of communication aids, computer access and interface devices is a lack of semantic agreement. So if you will bear with me, I will be defining each of the terms I intend to use, and if you hear me using a term that you're unclear about, let me know and I will attempt to define it for the purposes of our discussion.

Now for the disclaimer. Much of what I will be presenting in my section of the talk does not necessarily reflect anyone's opinions but my own. How intelligible is a certain synthesizer? How easy is it to read an LCD display? These opinions are subjective, to say the least. Little if any empirical research exists to guide us in decisions relating to many of these subjective judgments. I feel a need to state this even though it would seem obvious. In our rush to obtain reliable advice and information in this area we often overlook the necessarily subjective nature of this information.

In a very recent discussion I had with a communication aid manufacturer, I was warned that what I say this afternoon might be taken as "gospel" because of my affiliation with the Trace Center. I don't know whether that's true or not, but one thing this same gentleman said did cause me to temper some of the more emphatically biased statements I was prepared to make. He said that many practitioners of his acquaintance in the field of augmentative communcations feel paralyzed in their attempts to prescribe an aid because something bigger and better is always just around the corner. Anyone who has purchased a microcomputer knows the painful truth of that statement. Indeed, something "bigger and cheaper" usually is announced, if not appearing on the shelves of your local computer store, the minute you get your computer home. However, that should not be a reason to delay a decision indefinitely. We have to weight the value of acquiring a device which is "better" in some way against the value of having a device which may not be optimal but is at least functional today. Especially in the case of applying a device with a young child, or a young person in the educational system, delay and resulting missed opportunities can mean irretrievable loss. So, I must preface my statements by saying that the critiques I am going to offer should not convince anyone to delay a decision on acquiring an aid system. Peoples' immediate needs are important and deserve to be met now, not when it is easier to make a decision, because in the forseeable future it is not going to be any easier to make a decision.

We all appreciate the dilemma, however. It reminds me of an incident that occurred to me recently. I wonder how many of you may have had a similar experience. A friend and I were driving home, I was at the wheel and he was giving directions. Well, my friend has CP and his speech is quite difficult to understand. It sometimes takes several passes and then some guesswork. At any rate, he's navigating and I'm driving - not the best of all possible situations, but probably better than the reverse, given his incoordination and my poor navigational skills. At any rate, I was having a hard time understanding what he was saying at one point and we became lost. Or so I thought. I had to pull off the road so I could concentrate on what he was saying and figure out where we had gone wrong. By this time my friend was laughing hysterically which made him all the harder to understand. The point at which he had begun emphatically trying to communicate a few minutes before, was the point at which I had decided we must be lost, since my friend was flailing away at me. When we got it all straightened out I found that he was trying to tell me we were right on track, not lost, going in the right direction even though I had taken a wrong turn a few blocks back. Right. Thanks, Bill, for the encouragement.

So, my point to you is that communicative delay can be as dangerous as making a wrong turn, or choosing a device which will be improved upon or made obsolete in the future. One of the emerging design criteria among manufacturers and rehabilitation engineers in this field is modularity, allowing hardware to be upgraded as improvements become available. This should ease decision-making for the consumer. Sometimes, I know, we also feel that we have only one shot, and we have to make this financial investment that is not refundable or replenishable. This is another feature of decision-making on aid systems that often works against us. But, we'll be getting into these issues later in our discussion.

For now, let's define some terms. We will be talking here about conversation, control and computer access aids. What we are trying to convey with that big mouthful of words is the idea that "communication aids" as we have known them now need to serve a number of functions beyond face-to-face conversation. Here are the three function areas we have identified:

1. Under the heading of "conversation" we include face-to-face conversation, defined as interaction in real time, and also telecommunication needs, defined as real-time message sending and receiving over distance.
2. Under "control" we include the operation of environmental devices, as simple as battery-operated toys and electrical outlets, or as complex and sophisticated as environmental control units and robots.
3. Under "computer access" we include writing (or word processing) and the ability to use standard and specially-designed software.

I had mentioned modularity as an emerging design criteria for manufacturers and rehabilitation engineers earlier. Another emerging design criteria that can be seen reflected in most of the commercially-available aids is the provision of these three functions. In fact, one aid system currently on the drawing boards at Trace has been named "TRINE" to reflect that three part functionality. I guess you can think of it as the holy trinity if that helps you to remember it. Not all popular aids provide these three functions, as we will see later.

Having defined the functions of an aid system, let us now look at the components. I will be talking about five major components of aid systems.

1. The physical interface is that part of the aid system that connects with the user's bodily control site. It may be a keyboard, touch panel, voice control, joystick, eye switch, electrode, head pointing device, mouthstick or any other method or device which is used to send information to the central unit. It is at this end of the system, hopefully, that you will find whatever physical customization is necessary for an individual user.
2. The selection technique refers to the method by which the signals from the physical interface are interpreted. Scanning, encoding, direct selection and combinations of these selection techniques are all used. The selection technique is not necessarily dependent on the aid or the physical interface used. As with modularity and tri-functionality, the trend in recent years by most manufacturers and rehabilitation engineers has been to design aid systems which are capable of supporting various selection techniques. Some aid systems are, however, designed to support a particular selection technique; this is not necessarily unwise, though it may limit the marketability of a particular device. The Tetrascan and Scanwriter, for example, support only scanning, but they do so

in virtuoso fashion.

3. Acceleration techniques are used to speed up message rate or to increase content derived from whatever means of information transfer is available. Rate of information transfer remains the single largest stumbling block to the effective use of aid systems. Given the fact that the vast majority of aid system users are not capable of ten-fingered typing, and that not even ten-fingered typists can keep up with a usual conversational rate of around 200 words per minute, acceleration techniques must be used to enhance communication rates. Encoding, which I mentioned before as a selection technique, can also be used as an acceleration technique. When 3 digits are used to represent a phoneme, encoding is being used as a selection technique. At the same time, and on the same aid system, three different digits might be programmed to output an entire word. In this case encoding is used for both selection and acceleration. The Phonic Ear Vois 140 is an example of this technique.

Another common example of an acceleration technique would be the use of menu items used to indicate selections. Blissymbols represent an acceleration technique, although they are of course much more than that alone, they use a symbol to represent an idea. Recent examples of acceleration techniques include the Minspeak system from Prentke Romich Company, the Loleco program from Adaptive Communication Systems, and Speedkey, coming soon (we hope) from the Trace Center. In all of these systems, one or two selections, be they pictures, letters or numbers are expanded by the aid system to represent a word, phrase or sentence to the message receiver. Other examples of acceleration techniques include anticipatory scanning and word and letter frequency layout schemes commonly in use on many aid systems.

4. Output forms or actuators you can think of as simply the end result of this stream of information from the aid system user to the message receiver. Displays, whether LCD, LED, CRT, VDT or any of the other dynamic type acronyms you can come up with are in this category. So are printed output, voice output or output in the form of action by any other device such as a turtle or an environmental unit.

5. Finally, to complete this path of information transfer, we must talk about the underlying processes involved in the formulation, coordination, and execution of communication and control activities, including language, motor control systems, perceptual motor coordination, cognitive processes, etc. This is the area that we know least about. As engineers, clinicians, teachers and educational technologists, we have only begun to design tools which will allow us to study these processes in our clients. And we frequently make fallacious assumptions about the unknown capabilities of memory, language learning and social skills required by these marvelous high technology devices we are busily creating. If, as one author has named it, augmentative communication is the "dark continent" of rehabilitation, surely the underlying processes involved in the application

of these aids is the "dark continent" of augmentative communication.

Thus far, I have described the functions and the components of a complete high technology aid system. Let us now look at some of the commercially available systems on the market and begin to name names. My purpose here is not to provide a blow-by-blow comparison of the individual systems I will mention, but rather to see how well the entire field measures up to providing the user with necessary features, and to stimulate discussion of the ways in which these necessary features might be better provided.

I will mention 4 different aids in my discussion. Each of these have been presented at this conference and they are on exhibit. Each represents a slightly different approach to the problems they address. Once again, let me stress that my intent is not to evaluate the performance, quality or technical specifications of the individual aids, but rather to point out features and similarities in the field as a whole. I do not have, and I do not believe anyone has, the data to demonstrate that one of these aids is any better than another. Some lack certain features. Some would be more appropriate for a given individual than another. There are literally dozens of aids on the market that may be very similar or even superior to the aid systems I will mention. I will mention these four aid systems which are well known and are each prominent for varying reasons. I will mention the Express III, the Tetrascan and Scanwriter, the Phonic ear Handivoice, and SpeechPac. The commonality that these aid systems share is portability, voice output and fairly heavy marketing in this field. Beyond that the similarities end. Let's take a look at how well the three function areas are served by these and all other currently available aid systems.

Communication

In the first area, communication, let's look at a particular output form - voice. How good is it? How intelligible is it? How useful or necessary? Certainly, it seems to be the hottest development in augmentative communication in the last few years. John Eulenberg spoke for a lot of people when he said that if radar ranges and coke machines can talk, so should communication aids be able to help people talk. So far so good. I think we can all see the advantages to providing a natural-sounding, artificial voice to a person who lacks the motor control to produce speech. However, (SLIDE) do current communication aids actually talk? We know that they make sounds which the message retriever can learn to recognize to varying degrees. However, it must be said that the currently available synthetic speech in these aids is far from 100% intelligible to the untrained ear. In fact, if I were to hazard a guess, and, believe me, I know that this is hazardous, I would have to say that my experience with four of the five aids I've mentioned would lead me to guess a ratio of less than 50% intelligibility on unique messages to the untrained listener. Several points must be remembered in this discussion:

1. Speech synthesis technology is still improving dramatically, and some existing voice-output aids will be upgradeable as the improvements continue.
2. Voice output, even if largely unintelligible to untrained listeners, may serve an important function for the user in establishing control over his environment, gaining attention, or conferring status upon the user. Voice output has been shown to provide a strong reinforcer and motivational tool as feedback to pre-schoolers

in language-learning tasks (Meyers, 1983).

3. In some cases, those receivers in the user's immediate environment will become expert listeners, and the intelligibility ratio will rise; it has been demonstrated that many listeners can with relative ease and rapidity, acclimate to a synthetic speech "accent."

On the other hand, questions must be raised about the functionality of synthetic speech which is less than 50% intelligible. Intelligibility is extremely subjective; much of what we glean from everyday conversations is derived from context: positional indicators, emphasis cues, inflection, listener's expectations. This makes intelligibility difficult to isolate and study. How well will a child's peers be able to understand or accept his synthetic speech? Studies in this area are only beginning, and our observational experience is limited, but it is time to open up discussion of these issues.

If voice output is seen as a necessary and desirable feature of the aid system sought, what limiting factors should be taken into account? For one thing, an additional output form is absolutely necessary when using voice output. In noisy environments current synthetic speech systems do not function well, because of both low volume and increased discrimination difficulties. In some cases volume can be increased through the use of an external amplifier, but this does not solve the increased noise ratio problem. In some systems, the voice output draws enough power from the aid to necessitate dependence on another output form for use when the charge is low or depleted. As with any electronic aid use, non-electronic backup systems such as a pointing board, cards or at the very least, visible "yes-no" signalling descriptions written on a prominently displayed card should be considered.

Yet another factor to consider in thinking about the application of synthetic speech is how flexible the device user can be. One aid-user with whom I frequently converse by reading his written display had a very hard time making a synthesizer perform for him because it was extremely intolerant of spelling errors and other extraneous or missing characters. Unlike a human de-coding the written display, a synthesizer is unable to automatically filter out typos, thus introducing an additional noise element into the information transfer equation. And many aid users have educational deficits which include poor spelling and memory skills.

In their current manifestation, I believe that speech synthesizers can best be thought of as perhaps providing additional speech cues to the listener, as well as sound effects and signalling capabilities. They may also provide the user with an additional expressive outlet. In constructing exceptional pronounciations the user can exercise creativity and express his own personality in a new audible way. This has undeniable value. However, I do not believe that the current aid user today is enabled to "talk" with all that term implies, by the mere addition of synthetic speech capability, and it does not serve anyone's interest to pretend that he is.

Just a footnote before I desert this controversial topic. I was recently told, by a person who shall remain nameless, that we at the Trace Center have had our appreciation of synthetic speech spoiled by listening to the DecTalk too much. Perhaps that's true. The DecTalk is larger, heavier and much more expensive than any of the speech synthesis technology I've been talking about so far. There can be no argument that it is also much more intelligible. It was not battery-operable, but we have adapted one unit for portable battery-operated application, mounted on a wheelchair. The price difference between the DecTalk, which has 11 voices including several women's and child's voices, and the synthesizers I've been referring to in currently-existing aids, is about $4000.

I have a friend who was a singing teacher until he hit a high E a little too hard. Workman's compensation allowed him to purchase a voice output aid system while he underwent 7 weeks of voice rest. And among all of this man's observations about his vocal odyssey, one stood out among the others. He was fond of saying that he is grateful for the Volkswagen aid system the state of Missouri allowed him to purchase, but he reminds listeners that his former voice was a Cadillac. If you haven't heard the DecTalk I have a phone number you might be interested in trying. But only if you like Cadillacs.

The closest real time "talking" that I have personally heard from a commercial aid user came from a man who would be described as a "master tool user." Using phonemic input and digitalized speech output on the Phonic Ear Vois 140, I have observed an expert user holding an oral conversation in real time, at a slowed but functional rate of speaking. But phonemic input also has drawbacks. It cannot be directly transcribed to traditional orthography written communication. This expert user must audio tape any messages he needs to convey, as written output is not enabled by this method or device. Those already familiar with traditional orthography, spelling, would have to learn a new phonemic orthography. And, on this particular aid, text-to- speech and computer access capabilities are totally absent. Yet, for the single function provided, the Vois 140 would seem to fall into the category of a tool rather than a toy.

Telephone Use

The capabilities of synthetic speech for telephone communication are of great interest currently. At least one device has been created expressly for the purpose of telephone communication via synthetic speech. How effective is it currently? Again, the answer is unknown. Two things can be stated. Synthetic speech may actually be more intelligible when filtered through the telephone transmission bandwidth than when unfiltered. This somewhat peculiar artifact is due in part to listener acceptance of a natural voice transmitted via telephone which is also missing some of the aural information present in face to face communication. This observation is unqualified: the only sure way to satisfy yourself as to its validity is to try out the device in question over the phone and form your own highly subjective, biased opinion as I have. There really aren't enough of these devices in use yet to collect information on their functioning in the real world.

Secondly, user techniques need to be developed to assist in successfully applying synthetic speech to telecommunication needs. An answering tape which alerts the caller to the system being used and includes some brief tips on how to proceed has been used by one client I know of. Unfortunately, in this case user and caller intolerance of the signal-to-noise ratio in the aid system's synthesized messages resulted in a failure to use the system at all. It should be noted that the user in this case had a temporary disability, and consequently, perhaps, a lessened motivation to make the system work.

For many people the telecommunication function is critical to support independent living. Telephone usage is absolutely necessary for safety and health reasons. As consultants and clinicians, we should be likely to notice this need since we are frequently on the other end of the line trying to retrieve what is often a very information-poor message. Why have we not responded to this need? All of the expensive, limited-function devices on the market will not supplant effective training to telephone communication techniques. Here are some simple strategies I have found in use by some augmentative "masters."

1. The person using a combination of natural speech and augmented communication should check the accuracy of the transmission frequently. One person I talk to does this by ending most sentences with "Right?" and waits for an affirmative before going on. If he gets a "No, sorry" his next utterance is preceded by "Okay" before he launches a repeat or a variation of the utterance which was not properly received.
2. Similarly, the message receiver should echo the transmission if there is any doubt about its content and offer an opportunity to correct it.
3. The message-sender should know when to give up pronouncing a word or phrase and spell it. The receiver can assist by asking for spellings if necessary.
4. One individual I know and communicate with by phone on a weekly basis uses an interpreter very effectively. His phone calls are always welcome because the first thing he does is to set the topic and the length of the conversation, as well as the expected action he is seeking in calling me. All of our phone conver sations should be so succinct! This individual has learned to dispense with statements about our health or the weather as well. He respects my time and the limitations of this particular mode of communication. When we need to talk privately or in greater detail, he calls my computer via modem and puts a lengthy treatise in my electronic mailbox. Or, we speak interactively via computer. At his end he can type about 16 words per minute using a mouthstick and straight spelling. On my end I can talk with someone in my office, read the paper, watch TV or file my nails; use that time. If it's the end of the day I can lean back and catch my breath. I have found this particular mode of long distance communication very relaxing, and am in all honesty much more willing to converse with this person at length even though he is using a slow augmented rate.

Somehow we need to incorporate these techniques of augmentative master communicators into the uses we make of electronic telecommunication devices. I am not at all sure that we are currently developing these aids in tandem with the master tool users who can provide this information.

Written Display

No discussion of voice output would be complete without taking a look at the visual displays accompanying voice output devices. I will state categorically that at this stage of the game, with voice output being what it is, an alternate written visual display is necessary to back up the voice output. Four of five aids mentioned have both dynamic LCD displays and built-in printers. However, it is extremely difficult to read the LCD displays in actual interaction. Consider the Autocom. For all of its shortcomings, one thing it did have was a clear, readable LED display. It even has a separate, modular, tiltable display unit which could be mounted to face the message retriever. How important is face-to-face communication, eye contact, facial expression, gestural cues? (turn back on audience) Well, maybe it's not really important. Maybe face-to-board communication is just as good. Before I have the manufacturers jumping up out of their seats let me say that I appreciate the technical problems involved with providing the kind of clear, readable, modular display I'm talking about. But we should admit that while the LCD displays have allowed us to solve one technical problem in the power supply area, their use actually represents decreased functionality in another area to the aid user. Can we perhaps find a technical solution to this problem? One which is affordable? I would submit that we can't until the importance of the visual display is first recognized. And what about these printers? How are they actually used?

The printer on the Epson HX-20, which is the core of both the SpeechPac and Words Plus systems, is very noisy. It requires additional communication time to first send text to the printer, wait for it to print, advance the paper, and then rip and read. I have been told by an Epson user that this noise inhibits his use of the printer, although with encouragement he has been willing to make greater use of it. The printed output is invaluable for private conversation and messages that take a long time to compose.

Control and Computer Access

I will touch only briefly on these areas. They are covered in more detail in several of the presentations at this conference.

As mentioned before, tri-functionality has become almost a standard in the augmentative field in the past several years. Computer access and remote operation of devices in the users' environment are seen as absolutely necessary functions for multiply-handicapped people having cognitive impairment as well as for those who are cognitively intact. Software development for those with mental retardation, learning disabilities, brain injury and language disorders has progressed markedly over the past several years.

What, then, is the rationale for an aid design which does not provide either of these functions? Would it be possible to implement the apparently successful selection and acceleration techniques of the Phonic Ear aids in a configuration which allows computer access and control functions?

All of the other aids thus far mentioned - The Express, the Tetrascan, and SpeechPac - not only provide, but readily facilitate computer access and control functions.

The Tetrascan has a built-in keyboard emulating interface; the other aids mentioned, with exception of the Phonic Ear aids, interface easily with available emulating interfaces which are now available. Thus, transparent access, defined as the ability to use standard software without necessitating standard keyboard input, is now readily available. This represents real progress from first specialized software and then intermediate, low-cost solutions such as the adaptive firmware card.

Another development that is currently available in this function area is the provision of a wireless link, whether infra-red or some other technology, to provide remote control of a standard computer or environmental devices from the aid system. This has been implemented on the Tetrascan and the Express III.

The major problems in this area lie not in the design or functionality of the existing devices, but in availability and cost. Environmental control units may cost as much as all the other components of the aid system combined, including the computer. Keyboard emulators must be specifically designed for the particular computer they are to be used with; thus, the person wishing to use an aid system with a computer in a vocational setting will be frustrated unless the computer he wishes to access happens to be an Apple II+, IIe, or IBM-PC. And with new computers appearing constantly, this is not a trivial consideration. Being tied to a particular computer limits mobility.

Summary

Now that we have discussed some of the problems in all three of the function areas defined, I would like to desert my tirade about the shortcomings of currently available solutions and direct your attention to some questions and problems which transcend the responsibilities of manufacturers.

I must thank Larry Weiss of Zygo for alerting me to this publication of the Office of Technology Assessment. It's called Health Technology Case Study 26: Assistive Devices for Severe Speech Impairments. This is an excellent publication and I highly recommend it to you.

In this document, the situation of aids provision is likened to the situation of orphan drugs - Those needed by too few patients to make their development and manufacture by pharmaceutical firms sufficiently profitable. I would like to suggest that we are involved in an orphan field - one in which insufficient resources across the entire spectrum limit the availability of effective solution strategies.

Of course it is unfair to blame manufacturers for this situation. A vicious circle where lack of knowledge begets errors, and where errors beget frustration with service delivery systems exists. Manufacturers should not be responsible for the funding of devices, or for the research on interfaces and acceleration techniques. Yet, in the absence of any other activity in this area, they are often cast in this role. Because there is virtually no funding available for research or training of clinicians or users, or for adequate information dissemination, we seem to spend an inordinate amount of energy chasing elusive solutions. I would like to quote briefly from this OTA document:

> "There is an old axiom in medicine that when there are many different treatments for the same disorder the likelihood is that none of them works very well. From the perspective of the severely physically disabled nonvocal person, the same principle applies in finding a payment mechanism for the assistive communication device that will meet his needs: The many potential sources for funding disguise the reality that reimbursement can be very difficult and sometimes impossible to obtain. Because no single agency in government or the private sector is specifically authorized to assist this population, all tend to say it is not their responsibility and try to shift that responsibility elsewhere." (Office of Technology Assessment, 1983)

One last thought I would like to offer for your consideration this afternoon. We have heard a great deal about the communication revolution, the explosion, the marvels that can be wrought by the decreasing price of technology. How many of the problems I have identified can be solved by decreasing hardware costs alone? We need to set goals - what is it we can accomplish and want to accomplish? Isn't it time that we begin to decry the orphans status of this field and discover not simple solutions, but real ones?

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THE HOLISTIC APPLICATION OF HIGH TECHNOLOGY FOR CONVERSATION, WRITING, AND COMPUTER ACCESS AID SYSTEMS

BARRY L. RODGERS

ABSTRACT

In order to successfully use high technology for conversation, writing, and computer access aid systems I believe we must apply it holistically. A holistic approach is one where all the components necessary are in place. Recognizing the difference between technological toys, tools, and appliances and recognizing that aid systems are tools that will allow us to use our experience with other technological tools to identify the necessary components to apply high technology successfully. This will suggest among other things, that providing services such as ongoing training to comfortably use the aid system in real situations is as important as providing the device itself. Many of these services will be provided by a professional "Aid System Integrator."

In the future, the physical part of high tech aid systems will ride on the COATTAILS of general purpose computer devices. Many high tech aid systems will be designed using off the shelf portable computers in a standardized modular aid system I call the GAIN System. Finally, in order for high tech aid systems to be used successfully third party funding sources will provide ongoing support for holistic application and much of this will be for needed services.

A Holistic Perspective

I suggest that by using a holistic approach to the application of high technology that we greatly increase the chance it will live up to its promise for improving the lives of disabled people. By holistic application I mean making available all the components of the support system that are necessary to use high technology effectively. With a holistic perspective we understand that the whole system is greater than the sum of the parts and that parts by themselves are relatively useless. This suggests that the potential value of high technology will only be reached when all the components necessary to totally use it are in place.

In order to successfully use high technology for conversation, writing, and computer access aid systems we must apply it holistically, we must create a complete application system. If any parts are missing or malfunctioning the usefulness of high tech aid systems is greatly diminished or destroyed. This is analogous to the successful use of microcomputer systems. A typical computer without an appropriate task, appropriate software, effective documentation, a trained operator, electric power, or a desk to set it on is useless.

In order to apply high tech aid systems holistically we need a perspective that helps identify all the components necessary. I would like to give you a perspective that does this. I hope that it will help you think about what is needed to successfully use high technology for disabled people. I believe that if we hold a clear vision of what is needed we will be able to find ways to provide it.

To make it easier to understand this vision of the holistic application of conversation, writing, and computer access aids I will describe it as if it will definitely be used in the future. Of course it may not, but I think this perspective of the holistic application of high tech aid systems has much to offer in helping to realize the potential benefits of high technology for disabled people.

1. By comparing technological toys, tools, and appliances we recognize that high tech writing, conversation, and computer access aid systems are tools. We recognize that like other tools the results obtained with them depend as much on the skill of the user as on the quality of the tool. This suggests in turn that in the future providing ongoing training to comfortably use the aid system in real situations is as important as providing the aid system itself.

The technological toys I am referring to are promoted as useful tools but lack real usefulness. They are actually intriguing demonstrations of the possibilities of technology and I call them technological toys because they are primarily novelties. They are typically more trouble to use than they're worth. They are often hard to set up, often turn out to be harder to use and more expensive than more traditional approaches, and they have to be pampered or they will get out of adjustment or break. An example of toys that are sold as tools are the $12 magic kitchen slicer, dicers occasionally advertised on TV. If you've ever bought one of these, as I have, you know that after the novelty wears off they end up in a closet. How often do you really need a half gallon of sliced onions?

Appliances are devices that do something without requiring skill from the user. A perfect appliance is "goof" proof and is completely automatic. The results are independent of the skill of the user. A self defrosting refrigerator is a good example of an appliance. All you do is plug it in. There is no skill to learn that affects the results. It maintains its internal environment automatically. Most people today are more familiar with automatic appliances than they are with tools.

Tools to me are devices that are used by a skilled person to do something necessary in their daily life. The chief characteristic of a tool is that the results obtained with it depend on the skill of the tool user. A good example of a tool is a kitchen stove. It helps you cook but the results you get depend on your skill as a cook. With the same stove I may be able to heat a can of chili while another person is able to create a gourmet meal. The results you get with the stove depend on how skilled a cook you are.

A good tool is a work of art. Learning to recognize a good tool is sometimes difficult unless you are a master tool user. Subtle differences that are often difficult or impossible to describe make the difference between a tool and a fine tool and a piece of junk. How do you quantify the difference between a knife that feels good in your hand and one that looks the same but does not feel as good.

Conversation, writing, and computer access aid systems are tools because the results obtained with them depend on the skill of the user. They require a commitment on the part of the user to practice and develop skill in applying them to everyday needs and situations. They are tools because they must be improved by observing their use in different real situations to do important necessary tasks. By learning to recognize high tech aid systems as tools people can avoid being frustrated by trying to use technological toys.

High tech aid systems must be more than technological toys because people depend on them, have to live with them, are judged by the results they get with them. Good tools make any task easier. Toys can make any task difficult. Even a master carpenter will find it impossible to make a square cut if she or he has to use a toy saw. Technological toys that are tried as aid systems will be rejected because they're more trouble than they're worth. People will not be dependent on toys.

Conversation, writing, and computer access aid systems will never be appliances either. At best conversation, writing, and computer access aid systems will be tools that act as effective mediums of communication. Aid systems will never work independently of the user the way an appliance can. That would be analogous to having a telephone carry on a conversation for you. It would be like having your mother talk for you. Most people want to speak for themselves.

People often confuse good tools with appliances. The telephone is a good tool and can be confused with an appliance because it is relatively easy to use and is very reliable. However, it is not automatic. For a given purpose such as selling it still has certain advantages and certain limitations. It is up to the user to maximize the advantages and minimize the limitations. The telephone itself can't help with this. Some people can be very persuasive on a telephone. Others have difficulty sounding sincere. The results of the conversation still depend on the skill of the user just as the results of conversation using any other conversation aid will depend on the skill of the user.

The fact that conversation, writing, and computer access aid systems will never be appliances suggests that users will always have to spend time and energy to develop skill in using them successfully. Users will understand that these systems can never be automatic like other appliances, that no super computer can converse for them just as no person can converse for them. They will understand that the results they get will depend in large part on training and on their determination to develop skill.

Conversation and writing aid systems are like musical instruments. Musical instruments are superb examples of what I mean by tools because the quality of the music depends on the skill of the musician. A fine guitar is a fine tool and a virtuoso guitarist is a master tool user. Musical instruments are like conversation and writing aids because they are mediums of communication. The dedication, training, practice time, and skill required to communicate with a musical instrument demonstrates characteristics required to use a conversation, writing, or computer access aid successfully. A good conversation aid user literally "plays" their aid system the way a musician plays a musical instrument. This requires training and practice. We don't expect to get music from someone by simply putting a saxophone in their hands. Mastering an instrument requires an understanding on the part of the learner that it may take time before they can make satisfactory music and that they will need the help of a teacher.

This points out the importance of making aid systems that will be easier to learn. If all conversation aid systems were as difficult to learn as a violin is for nondisabled people then very few people could benefit from them. It points out that good aid systems will be as beautiful, reliable, and practical as a good guitar. It points out that effective and ongoing training to comfortably use the aid system in real situations will be as important as providing the system itself. It points out that developing mechanisms to accumulate wisdom about successful strategies for aid system use from the master users and mechanisms to pass that wisdom on to new users will be an important component in the evolving usefulness of aid systems.

2. Recognizing high tech aid systems as tools allows us to understand that high tech aids are perfected from actual use over time. It allows us to understand that aid system designer/developer/manufacturers will be people who get their primary satisfaction from seeing their systems used successfully in real situations. They will also be people who like to continuously perfect and improve their systems.

Tools are perfected over time. Most common hand tools have been perfected through generations of use by master crafters. This is an important difference between a "technological toy" and a "tool." Technological toys appear and disappear quickly and thus never get improved and refined to the point where they are really useful.

A true technological "tool" must go through a series of cycles of improvement. These cycles consist of field use by the master crafters who use the device day in and day out, followed by refinement by the tool maker based on the feedback of these master craters. To get a useful tool, I think takes at least 3 cycles and may take many more. A characteristic of truly useful tools is that they are always undergoing refinement. After thousands of years of use there are companies that are still refining the kitchen knife.

In the future, we will be able to recognize conversation, writing, and computer access aid systems that are truly useful tools by observing their refinement over time. Orphan systems that have stopped evolving will be recognized as bad risks. Systems that are undergoing continuous refinement from actual field experience will be highly valued and sought after. Systems that have visible and viable mechanisms for fostering their improvement in use will be the most prized of all.

Tools are made by toolmakers and toolmakers can be distinguished from puzzle solving toymakers. in the future, we will distinguish tools from technological toys by understanding the characteristics of toolmakers as compared to puzzle solvers. I believe that technological toys are often made by puzzle solvers. Puzzle solvers are people who are motivated and get much satisfaction from solving puzzles.

New technological opportunities are like puzzles for them. They play with technology to see what they can get it to do. They treat high tech components as puzzle pieces to be fit together into a device that meets some idealized and abstracted use. The internal question is often "I wonder if this device can do that?", "I wonder if this microprocessor has enough power to do a text to speech translation?" However, once the puzzle fits together, once the demonstration has been made, that puzzle becomes boring. The puzzle solver then moves on to something else.

The toolmaker is a different breed entirely from the puzzle solver because the toolmaker gets satisfaction from seeing his or her tools used by people. Piecing together a device and getting it to operate is only the first and perhaps least important task of the toolmaker. The toolmaker is interested in perfecting the device in use. This means getting people to try the device, watching them try to use it, questioning them on how to improve it, taking it back and fine tuning this or shaving a little off that or even throwing it out and starting over.

To the puzzle solver it really doesn't matter whether or not the technological device meets a real need or is really useful. The satisfaction for them comes from solving the problem as first abstracted in their mind. This abstract postulate is the challenge. Even though some puzzle makers imagine that they have created a tool, it can be very frustrating for them to have someone actually try to use their device. This is because all the real conditions and limitations spoil the sense of satisfaction the puzzle solver gets from the perfection of their abstract solution.

On the other hand, the toolmaker's main satisfaction comes from seeing the tool used by people. The toolmaker goes to great lengths to get feedback from the master crafter, the master tool user. The real life complications and the inevitable compromises are exciting challenges to the toolmaker. The art of making a useful tool is as much a concern with how people work as with what technology can do.

Good toolmakers are recognized as artists. Like other artists they must constantly see their work in context. They must constantly make precise compromised judgments that rely on their ability to see the entire system including the person using it at once; to be able to anticipate the subtle interplay of the components that will create a synergistic whole; to create a system that works unexpectedly well.

3. Recognizing high tech aid systems as tools also allows us to use our experience with other high tech tools to identify the functions necessary for holistic application. Holistic application is providing everything necessary to be successful.

The holistic application of a high tech aid system will require the following components:

1) Locating people who can make use of the aid system.
2) Establishing their needs and capabilities and the potential benefits of an aid system.
3) Selecting and acquiring appropriate system components including special market hardware and software, and general market hardware and software.
4) making simple modifications to hardware and software if necessary to make it compatible.
5) Assembling the aid system.
6) Mounting the aid system on the users wheel chair, shoulder bag, bed, etc.
7) Fitting the aid system to the user including adjustments, modifications, and initial customization.
8) Selecting the most effective aid system training aids (manuals, video tapes, demonstration programs, etc.)
9) Initially training the user in the basics of the system and how to optimize it for themselves.
10) Training the people in the users environment who will need to help the user maintain the aid system.
11) Providing ongoing training to make sure users get all possible benefit from the aid system
12) Being on call to answer subsequent questions about the aid system as it is being used.
13) Providing ongoing preventive maintenance and replacement of worn-out parts.
14) Providing repairs.
15) Updating the system when significant improvements in available functions make it desirable.
16) Periodically evaluating the degree of integration of the aid system in the user's life and providing suggestions or further training as necessary.
17) Using information gained from users in the refinement and improvement of the aid system.
18) Providing a different more appropriate aid system when the user's needs or capabilities change.
19) Providing a different more appropriate aid system when significant advances in aid system design make more useful aid systems available.

Notice that only item #3 focuses on the hardware and software itself. The other 18 items relate to services to support the user and the system over time. This points out that when high tech devices are "Holistically applied" services such as systems integration and ongoing training will be at least as important as the devices themselves.

4. In the future, in order to provide many of the functions of holistic application there will be a professional "Aid System Integrator" working for aid system users or third party funders.

Many of the services required for holistic application of high tech conversation, writing, and computer access aid systems require a person with unique knowledge and experience. I call this person an Aid System Integrator because they will be able to integrate the components into an appropriate aid system and because they will be able to help the user integrate the aid system into their lifestyle. There are already people doing this work but in the future they will have a clear identity and role and be committed full time to this profession.

The Aid System Integrator will be the user's technological consultant, advisor, and advocate helping him or her get the most from available technology. The Aid System Integrator will work for the user in putting together the most appropriate aid system in conjunction with other therapists such as speech and language pathologists, seating specialists, and occupational therapists. They will provide the primary support for the aid system. They will provide many of the services listed earlier including helping users select, put together, setup, and learn to use aid systems. They will provide ongoing evaluation, training, adjustment, modification, and repair of the aid systems.

In the future, the Aid System Integrator will work for aid system users or third party providers on a fee for service basis. They will not represent a single designer/developer/manufacturer but will work with all designer/developer/manufacturers just as an independent insurance agent works with many different insurance companies. They will be paid for services in the same way other professionals such as dentists and accountants are. They will establish long term relationships with their clients.

The Aid System Integrator will be comfortable with high tech devices and will be trained to confidently assemble aid systems from devices made by different manufacturers. They will be a special kind of toolmaker. One who assembles tool systems from available components. They will have a technicians knowledge of electronics and be comfortable with simple computer programming tasks. They will also be trained in locating resources. A big part of their service and expertise will be in keeping up with what is available for special needs.

Aid System Integrators will also be people oriented. They will be trained to be good teachers. They will teach people to become proficient with their systems and to feel good about using them. They will be comfortable working together in a team with other clinicians such as speech and language pathologists and occupational therapists. They will be the sort of people who get satisfaction from seeing their systems used successfully in daily service by their clients.

5. In the future, the physical part of high tech conversation, writing, and computer access aids will ride on the COATTAILS of general market computerized devices.

Most of the physical part of these aid systems will be designed around general market high tech computers. I call this approach to aid system design the COATTAILS APPROACH which is an acronym for Computer

Opportunities Applied To Technological Aids In Linked Systems.

> Computer Opportunities refers to the opportunities to make powerful yet inexpensive aid systems from general purpose computers as well as from other high tech consumer devices such as phone based environmental monitors and remote controlled entertainment systems. These general market high tech devices will cost less and less with more and more capability.
>
> Applied to Technological Aids means that we will apply this technology to making electronic aid systems for writing, conversation, and device access for disabled people.
>
> In linked Systems means that the aid systems will be systems configured by linking general market devices to specially made devices. The special market devices will act as accessible inputs for the general market devices. The linked system is modular and expandable with almost unlimited possibilities.

The COATTAILS Approach will be widely used because it will be more effective to make aid systems by programming and configuring general market devices than it will be to manufacture from scratch the entire aid system. There will by many reasons for this. Among them that this approach will require less capital investment, less development time, will be more efficient for small production, will be less expensive, will require less manufacturing expertise, will be more customizable, and will significantly reduce the time it takes to bring out a refined updated aid system.

Most of the "work" of "manufacturing" the aid systems will be in researching aid techniques, programming the general market devices, and in creating the effective training materials that will be part of the aid system. Relatively little work will be in traditional "manufacturing."

In the COATTAILS Approach manufacturers will be using off the shelf devices that anyone could buy separately. This will make the costs of "manufacturing" the system obviously separate from the cost to manufacture the hardware. It will be obvious that the value added to make an aid system is in development, programming, and training materials. Developing good software and effective training materials is expensive now and there are no indications that it will get significantly cheaper.

For this reason, users will understand that the aid system they get from the designer/developer/manufacturer via their Aid System Integrator is worth significantly more than the cost of a naked computer. In fact the "cost" of holistically applying the high tech aid system may have little or no relationship to the cost of the hardware.

6. In the future, many high tech aid systems will be designed using a standard portable computer in a standardized modular system I call the GAIN System.

This is one kind of COATTAILS aid system. It will be designed around battery powered portable computers. I call it the Gain system because of the gains in versatility and cost benefit ratio and because this is an arcronym that stands for Generic Aid I/O Network.

> Generic means that any brand portable computer may be suitable.
>
> Aid in this case means a high tech computer based conversation, writing, and computer access aid system.
>
> I/O stands for Input/output and refers to how special input

or output devices will be connected to the generic computer to make an aid system. The connections themselves will be generic or nonspecialized using standard ports already present on the generic computer.

Network implies that the system extends in several possible directions from the adaptive computer to the user and from there extends in many possible ways to other people and devices.

The GAIN System will be based on a general purpose battery powered notebook computer acting as an adaptive computer. The adaptive computer runs special software that allows it to adapt to the person using it. The software for the adaptive computer will be designed to take advantage of whatever communication/control capabilities a person has.

The GAIN System uses the standard input and output RS-232 ports on the adaptive computer. Specially made input devices, such as a chin control, will connect to the adaptive computer in a standardized way. Specially made interfaces allow the output of the adaptive computer to control other computers and other devices that a person needs access to in their culture. These specially made interfaces connect to the adaptive computer in standardized ways. By linking with other electronic devices in a person's environment the adaptive computer becomes part of a network that extends indefinitely. Thus the Generic Aid I/O Network gains access and gains power.

Here are the defining "attributes" of the GAIN System:

1) Uses a general purpose battery powered computer (Epson HX-20, Radio Shack Model 100, etc.).
2) Makes use of the computer's standard input and output ports.
3) Uses special market and general market input devices with stationary devices.
4) Uses a special market wireless link to connect the system to stationary devices.
5) Uses a keyboard emulating interface to access a standard computer.
6) Uses a Special market remote control emulator that can directly control general marker stereos, TVs, lights, telephone answering machines, emergency call systems, microprocessors, coffee pots, etc.

Here are the main benefits or "features" of the GAIN System:

1) Inexpensive hardware.
2) Modular can be tailored to particular needs.
3) Requires no hardware modifications to the off the shelf computer.
4) Portable but networks with stationary systems.
5) Can control standard computers running standard software.
6) Can be upgraded via software alone and the software can be modular to make changes and revisions easier.
7) Allows a manufacturer to develop an aid system without having to "manufacture" hardware.

Taken together GAIN implies the synergetic effect where the resulting system will be greater than the sum of its parts, a new gain. GAIN systems will be multifunction modular aid systems that are less expensive, more versatile, upgradeable, repairable, and improvable, and therefore, more likely to be truly useful to a disabled person.

GAIN systems will often be "configured" or put together rather than "manufactured." Since the physical part of the systems will be in large part inexpensive off the shelf devices and since most of the cost of the GAIN Systems will be in integrating these components with appropriate software and user training, the GAIN

Systems will more clearly service intensive. It is likely that pricing, delivery, and support will use the "service" model rather than the "product" model. For example, an environmental control system may be packaged and delivered the way some home security systems are today. You pay the professional security system designer for the time it takes to evaluate your needs and install and support your system. The cost of the components is listed in the bill under "parts." To look at this another way, you pay your dentist for her or his time and the cost of materials is usually negligible in comparison. You don't go to a dentist to buy a filling and get free installation.

7. In the future, when funding sources are needed they will provide ongoing support for everything needed to "holistically apply" high tech aid systems including needed services.

Funding by third party sources for high tech aid systems will include all the costs for making the systems truly useful. Society will have an understanding and acceptance of the ongoing need to support both the user and the aid system and this understanding will be reflected in policies by funding agencies.

To see how this would work in the future for high tech aid systems we can use the example of a mobility system consisting of a van, a wheelchair lift, and a wheelchair. The purpose of the system is to provide ongoing reliable mobility for a person so she or he can contribute in a regular job. What is the cost per year to support part of this system? Let's say the van with wheelchair lift and modified controls cost $11,000. Is this a one time cost to provide mobility for a person so that they can hold a job and participate in society? No, we know that it costs much more "over time."

In the future, part of the yearly cost would be computed as follows. In Wisconsin this van would last about 8 years before it rusted out. A 20 year old person needing mobility for 50 years or so would need at least 6 vans or a van every 8 years. This would be about $11,000/8 yrs = $1375/per year. The cost of the van does not include maintenance and repair so we must add an additional amount for that. At 10 cents a mile for maintenance on the van and 10,000 miles a year we must add $1000 a year. Thus this part of the cost to give a person mobility via a van is about $2375 per year.

This is still only part of the cost to apply the van technology holistically. In the future the cost to learn to operate the special controls of the van will be covered. Since each new van might have different controls the training will be paid for every time it is needed. In addition, the regular maintenance and repair cost on the wheelchair lift have not been added in yet. They will also be covered. The wheelchair is intrinsic to this system so ongoing maintenance and repair for it must be added in. Like everything else wheelchairs wear out so the cost to replace the wheelchair periodically must be added.

What about the cost to consult experts about the best kind of lift and the most appropriate control system to select for each new van. The technology will continue to change. Driving and the vans themselves will likely change with time. Only an unbiased expert will be able to make a good decision about what kind of system to get. In the future the services of this expert will also be paid by third part funding sources.

Thus, there are many ongoing costs that must be covered to successfully provide mobility with a van and wheelchair. Vans are relatively easy to learn to drive and easy to maintain compared to many computer based conversation, writing, and computer access aid systems. These systems may require even more ongoing support. Therefore, in the future if third party funding sources are needed they will support all the costs necessary to apply the high technology for aid systems holistically. This will include:

1) The cost of evaluation services
2) The cost of system integration and assembly services
3) The cost of the hardware and software components of the system
4) The cost of initial training services to learn to use the aid system
5) The cost of ongoing training services related to developing skill in using all the power and versatility of the aid system (this is different from and in addition to speech and language therapy, occupational therapy, etc.)
6) The cost of periodic maintenance services (cleaning keyboards and switches, adjusting and tightening mountings, etc.)
7) The cost of normal periodic parts replacement (like nicad batteries every 3 years)
8) The cost of repair services from equipment failure or accidental damage (LCD display going bad, spilling juice on the keyboard, etc.)
9) The cost of periodic system upgrade for both the materials (software and hardware) and the installation and training services (this will be necessary because manufacturers will refine systems over time fixing bugs and adding features)
10) The cost of replacing the system after its useful lifetime is finished (this will be necessary when the users physical or mental capabilities and needs change even if their aid system still operates)
11) The cost of comprehensive insurance to fix or replace the system if it is damaged or stolen.

It is worth noting again that most of these costs will be services.

To Sum Up

In order to apply high technology effectively we need a holistic vision where all the parts necessary to make a whole system are in place. By comparing technological toys, tools, and appliances we recognize that high tech writing, conversation, and computer access aid systems are tools and that like all tools the results obtained depend as much on the skill of the user as on the quality of the tool. This suggests in turn that in the future providing ongoing training to comfortably use the aid system in real situations is as important as providing that aid system itself.

Recognizing high tech aid systems as tools allows us to understand that high tech aids are perfected from actual use over time and that aid system designer/developer/manufacturers will be people who get their primary satisfaction from seeing their systems used successfully in real situations and they will be people who like to continuously perfect and improve their systems. Recognizing high tech aid systems as tools also allows us to use our experience with other high tech tools to identify the functions necessary for holistic application, where holistic application is providing everything necessary to be successful. In order to provide many of the functions of holistic application there will be professional "Aid System Integrators" working for aid system users or third party funders.

The physical part of high tech aid systems will ride on the COATTAILS of general purpose computer devices because this approach is more effective in developing aid systems into tools. Many high tech aid systems will be designed using a standard portable computer in a standardized modular system I call the GAIN System. Finally, in order for high tech aid systems to be used successfully third party funding sources will provide ongoing support for holistic application and much of this will go for needed services.

By understanding aid systems as tools we will be able to use our experience with other tools to help create ways to provide and use aid systems appropriately. By using this model we can develop appropriate approaches for designing, manufacturing, selecting, improving, learning, using, paying for, maintaining, insuring, repairing, and replacing high tech aid systems.

"WRITING TO READ": A COMPUTER-BASED, LANGUAGE EXPERIENCE, WRITING AND READING SYSTEM, AS USED WITH HANDICAPPED CHILDREN

ELEANOR R. KIRKLAND

ABSTRACT

"Writing to Read" is a computer-based program designed to teach students to "write to read." The program is based on the philosophy that students will learn to read more effectively and efficiently if taught to write, therapy and using the encoding of their normal language as the initial process in learning to read. Using the computer, the "Writing to Read" program helps children develop the skills required of successful writers and readers. It teaches the children phonemic constituents of the English language, not only the 26 letters of the alphabet, but also the 42 English sounds represented in many different ways. The program teaches the combining of sounds and letters to create words, and the combination of words into sentences. Finally, the program teaches the writing of illustrated stories, the bindage of pages into books, and the reading of books to peers and others.

The children take great pride in their work. The program has been a "great success" with the children who have a variety of problems/disabilities.

Today we have many concerns regarding the education of our children. There is concern over the number of "illiterate" children, particularly those at the secondary level. According to Council on Literacy, functional illiteracy costs more than $224 billion a year. We pay the price of incompetent job performance, lost tax revenue, crime, welfare payments and remedial education.

Some college and university students cannot pass writing and reading tests at the 9th-10th grade levels. In many schools across the country we find large numbers of new immigrants with little or no English. In addition, we have large numbers of children with communication/reading problems, and children with learning physical disabilities which deter learning. Of all students who fail, reading failures receive the most attention. Reading failure is the most commonly studied academic subject in learning disabled research.

Certainly writing and reading are very important skills; they are important no matter what the students' grade level. They effect careers that lie ahead and a student's ability to become a productive adult and citizen.

Our country's industrial climate and our own life styles are changing rapidly. Electronics, robots, and computers are more prevalent, particularly computers. They are now often appearing in large numbers in the school. Many people think that the computer has a great potential in education. I believe this is correct, if we are more careful in the selection of software. Much programming software is very poor, of no better value to the teacher than another ditto or work-book page. A lot of work still needs to be done to improve these programs.

We Must Do Something to Solve these Problems

Research has shown that all children acquire and develop language skills in the same order and sequence without regard to where they were born or the language that they speak. Throughout the world, children produce the same sounds in the same order; this is primarily due to their physical development. The first sound made by infants throughout the world is "aaah." "Aaah" doesn't require any control; merely by opening their mouths and emitting a small amount of air they produce "aaah," a short vowel. Next, sounds are produced with some lip control, first "mmm" then a combination of "mmm" and "ah" to form "Ma." You know what happens. A woman is standing close by; she hears the child say "Ma," which is repeated become, Ma-ma. With a little encouragement the infant says "ma, ma, ma, ma" because it is fun, and so it goes. Researchers have found that the word for mother starts with "mmm" in most languages. For instance, mutter in German, and Madre in Spanish.

Gradually, sounds string together to form the syllables and words spoken around the children. As they acquire language, they stop making sounds not included in their native language. For example, an English speaking child will stop making the "gutteral" sounds of German, the rolling "Rs" of French and the "Clicks" of some African languages, unless they later learn these languages.

In the development of language skills, children first listen; they hear the language being spoken around them. Second, they speak; they begin to make sounds and later words to convey messages and to communicate with others. It is interesting to note that all children throughout the world, speak first of the same things: people and things around them (nouns) and things they do (verbs). Third, they write. Researchers have shown that the scribbles of all young children include shapes and forms that resemble letters of the alphabet, numerals, musical notes, and familiar looking symbols such as "X" for Railroad Crossings found in this society. These scribbles gradually begin to look like familiar words. Many children will write something and then tell you what it is they wrote, or they will ask you what they wrote. The final step is reading; reading what they have written, or what someone else has written.

As we know this is the natural way children learn to write and read, why do we continue to use methods or procedures that confuse many children. All children have something to say. All children like to see what they say in writing; if it can be written, it can also be read.

"What I can say -
I can Write and
What I can Write -
I can Read!"

Through the use of the computer, the "Writing to Read" program develops the skills required of successful writers and readers. Students learn that speaking can be made visible; they learn that making words visible is called writing. They are taught, at first, to write words the way they sound. The philosophy, was designed and developed by Dr. John Henry Martin. The program is based on his philosophy that children will learn to read more effectively if taught to write, to encode their normal language, as an initial process in learning to read.

A personal computer (PC), equipped with voice output and color graphics, plays a central role in the program. Other program components are work journals that parallel computer lessons, a listening library of children's classics, typewriters, printers, and games.

The PC, using a digitized voice

attachment to eliminate the "nasal sound" associated with computer "voices," comes with 30 diskettes. The structure of the "Writing to Read" program is deceptively simple. Based on 30 key words and their phonemes, the program teaches children to write words the way they speak them, the way they sound phonetically. For example, in the first lesson the "C" in Cat is taught as "K" sound, not a "see" sound. The English alphabet uses 26 letters; the English languages 42 phonemes. Represented 500 different ways, the letters and phonemes are needed to speak all the words of English. For example, the sound is the same, but spelling differs, for the "oo" in school and the "ough" in through. It is no wonder that English is the most difficult language to write and read.

Consistent use of a phonemic spelling system allows children to write, and use their rich vocabulary, at a much earlier age than if required to learn all the inconsistencies of English spelling. As children develop their writing proficiency, they begin to recognize these inconsistencies and adjust their writing to textbook spelling.

In the program, phonemes are displayed around the perimeter of the PC screen. As the computer "voice" calls out a sound or word, the appropriate phonemes leave the perimeter and move to the center of the screen. The computer section of the program, in which the children spend 30 minutes working in pairs, relies heavily on repetition. In the first lesson, there are 33 repetitions of the word "cat"; the computer says "cat," and asks the children to spell it using the keyboard.

The program is individualized to the extent that the learning-cycles are self-paced. The computer waits for the correct response and does not respond to a wrong response. Thus, if a child is asked to type or write "cat" and an error is made, the incorrect letter does not appear on the screen. In a mastery test at the end of each cycle, students are asked to write the words they have just learned. If two errors are made, the computer recycles the instruction.

Each of 10 cycles consists of three key words. The cycle also branches out to introduce other words that can be formed using the same sounds. The 30 words introduced in the 10 cycles, introduce the child to the 42 English phonemes.

Other computer based instruction uses games, including a game that requires the child to write the word "mouse" fast enough to keep a pictured cat from catching a pictured mouse. Another game, the "silly sentences" segment, intends to introduce children to sentence construction. The children are asked questions such as "Did you ever see a pig in a bed?" (Pig and bed are 2 words introduced in cycle 2.); the children are shown a funny picture of "a pig in a bed" and helped to write a sentence.

Because of successful evaluations of the "Writing to Read" program during its early years (1978-81), Dr. Martin was moved to copyright his computer-based teaching system. Dr. Martin and IBM teamed up to develop an evaluation of the "Writing to Read" system in schools nationwide; approximately 10,000 children (kindergarten - 2nd grade) in six states participated in the study conducted in the Fall of 1982. The evaluation was extended through the school year (1983-84) with approximately 15,000 children involved in the program. The evaluation in 1983-84 included children with problems and disabilities as well as various grades and age levels. The program is being evaluated by the Educational Testing Services, Princeton, N.J., and the results of the evaluation will soon be available.

For the evaluation, IBM loaned computer equipment and published the program's printed and audio materials. (IBM owns copyright to the program.) The printed materials included "Teacher's Manuals" that provide additional materials, suggestions, and activities to assist in the operation of the hardware.

In 1982, a second study of program use by Kindergarten - 2nd grade children began. In June 1984, this particular portion of the study was completed. A report is being written which will show the progress of children who have problems in writing and reading using the "Writing to Read" program. As this conference concentrates on "Technology for Disabled Persons" below is described the use of "Writing to Read" in four schools in the service area of California State University, Sacramento.

Over the past two years, approximately 600 students have participated in the Sacramento program. The only students that began the program in 1982 and did not complete all of the phases, moved from the area. The group was very diverse and had many different problems. For example, the groups included: 1) A large number of Asian children, including approximately 50 Hmongs, hill people from Laos, who did not have a written language until several years ago when missionaries working with them helped develop a method to put their language into writing. 2) A special day class consisting of 4th, 5th, and 6th grade learning disabled students (12 boys and 3 girls ranging in age from 12 to 18 years). These children were placed in the special class to help remediate their learning, social, and emotional problems. 3) A group of children placed in the Resource Special Education Centers, and 4) A Special Education Center. The school had added a special wing designed specifically for Special Education. A central "Writing to Read" center housed all of the hard/software. Off the center are four classrooms with large open doorways: #1 is a self-controlled 1st and 2nd grades EMR class. #2 is a self-contained 2nd and 3rd grades EMR class and #3 is a self-contained 4th-6th grade EMR class. The fourth room is the Special Education Resource Specialist Center. A schedule was developed for each classroom to participate in "Writing to Read." This is ideal, because the teacher can move from the center to the classroom and monitor all students easily. An addition to one of the schools in the past year was a special first grade class with many Asian children and others at the readiness stage.

A program inservice was provided to directors, specialists, classroom teachers, aides and administrators before the centers were put into use. Informative meetings were also held for parents and others interested in the program. The staff of each center and school met once a month to discuss the programs, problems, suggested changes, and other topics relevant to the program.

Because of the density of the student population, the "Writing to Read" program was modified slightly from the original used with Kindergarten and First/Second Grade children. All of the participants, however, did follow all of the steps and procedures of the 10 phases of the program. The modifications were made to meet the needs of the children. For example, for work on the computer or journals an English speaking child was paired with an Asian child - particularly the Hmongs who had the greatest problems with writing. To help these children develop their vocabularies and an understanding of writing thought/sentences, group activities were organized for both English speakers and very English limited Hmongs. In the first sequence, they learned the words Cat, Dog and Fish and three sound symbol relationships of the words (e.g. the c, the a, and the t of cat). Pictures of cats from the Peabody Kit were used to develop vocabulary. Staff and students talked about the pictures of cats, what cats looked liked, what they ate, what they did, etc. and the group, then created a story. The story was written on the board, read, and reread. The story was finally written on a chart and placed in the "writing" corner. The children were encouraged to copy the story and illustrate it. After exposure to the three words in Phase I (cat, dog, and fish, introducing 10 English sounds), and after participating in the process mentioned earlier, a Hmong student wrote:

"I see dog.
Dog eat fish.
I crying."

The picture he drew to illustrate his story was a dog with a fish in his mouth.

This was remarkable as he had only been in the program for about five weeks, knew very little English, and had done very little writing before entering the "Writing to Read" program.

In some cases, because of the difference in problems, levels of ability, etc., it was impossible to pair children who went to the Special Education Resource Center. Consequently, some children worked on their own at the computer and journal stations. They did, however, participate with other children in some of the other activities.

During the "inservice" held prior to the program initiation, teachers were encouraged to use the program in their classrooms and to encourage children to read their stories to other children in their class. Because there was concern over spelling with older students (if they were encouraged to "write the way it sounds"), the following procedures were used.

When the children complete the exercises in the journal, they are asked to write a story using the three words and the sounds introduced in that cycle. They learn that they can write everything they can say. With the help of the teacher or aide, they learn to rewrite, to improve the clarity of their thinking on paper, and to use the correct phonemic symbol to their words. The adults are encouraged to give clues such as, "do you remember the sound you heard at the end of "fish"? but not to tell the child how to write the word.

A great deal of "word processing" actually takes place in the writing of stories. After correcting their writing with the help of an adult, the children type their study on the PC, read it on the screen and, if written to their satisfaction, their story is printed. The printed copy is edited more carefully with the older children.

In the editing process the children are taught how to write words as they appear in books, and to write paragraphs (indent). They then take their edited story, with suggested changes, to a typewriter and produce a finished product they can be proud of. They paste their story on a piece of colored construction paper and illustrate it. The stories are then taken to the classroom, read to others, posted on bulletin boards, or bound in a book.

At the "writing station" the children use typewriters to produce the "final edition" of their story. Many children, when put through the painstaking effort of writing with a pencil, tend to forget the word the letters express. With a typewriter, the letters are perfect and can be put together into words more rapidly. The children take great pride in their writing.

The progress the children made in writing stories was amazing. This process was eventually used with all of the children except the early readers, or students new to the program.

I found the multi-sensory approach most helpful for those children who had learning problems or some physical disability. Each child uses all of his senses when working on the computer, (1) he sees the word, (2) he hears the word, (3) he says the word, and (4) he writes the word. Learning is being reinforced continually. Some children who lack small and/or large motor coordination have a difficult time holding a pencil, writing between the lines, forming the letters in a certain way, etc. These children have ideas (many of them), and they know the words to describe, define and communicate their ideas, but they cannot put them on paper. They can, however, press the keys on the computer or the typewriter. They can see their words in writing and they can read those words. One very uncoordinated child had a difficult time holding a pencil, writing on paper by touching the dotted line, and drawing a circle or circling to the left to make a "C." He completed the first phase of the program and was introduced to cat, dog, and fish, and was doing the "mastery test" that asks each child to write the words cat, dog, fish, giving one opportunity to do it correctly. The computer "voice" said "write cat." The boy wrote cat on the computer, it appeared on the monitor because he did it correctly. He called out "Wow, I can Write!"; it was this child's first feeling of success in writing.

Children with minimal motor control can use special gadgetry such as sensitive micro-switches, light pens, or joy sticks to reach beyond their physical restriction and learn language through interaction with the computer.

Another example: Robert is a child who had been retained in first grade and now was in second grade. His past teachers all commented that he had done nothing for almost three years, that it was like "pulling teeth" to get Robert to provide a response, pay attention, etc. He had been assigned to the Special Education Resource Center. One day, while visiting the Center, Robert came up and said with a big smile "I can write cat." His friend, standing next to him, said "He can write dog, too." Robert replied, "I can write fish, too." Congratulations and hand shaking were given. Several weeks later, again when Robert was in the Center, he read a story he had written in his journal:

"Dogs get the cats.
Dogs always get the cats.
Cats get the fish.
Cats always get the fish."

"Always" was the only word he needed help with. This story was written after Robert had completed Phase I of the program. This same child went from the 6th percentile to the 98th percentile in the reading portion of the WRAT test.

Teachers have indicated that not only are the children improving in writing and reading skills, they are also enjoying their experiences, becoming more independent, and taking more responsibility for their learning. The children are taking pride in their work, particularly their writing of stories and books.

The program provides more time for the teacher to give attention to children with learning problems or disabilities; and to plan stimulating activities to encourage language skills. It gives the children an opportunity to write of their own personal experiences, and to share stories with others.

Computers will not take the place of teachers in the classroom, as has been suggested by some concerned teachers. Machines can't hug, so the teacher's role is all important.

N = New Student
R = Returned Student

EVALUATION
('83-'84)

RSP = Resource Special Education Program
NEP = Non-English Proficiency
LEP = Limited English Proficiency
ECIA = Title I
FEP = Faulty English Proficiency

Test Given: WRAT

*% Imp. = Percentile Improvement

Student Classification	Reading	*	Spelling	*
RSP	Grade Level Equiv.	% Imp.	Grade Level Equiv.	% Imp.
Average % Imp. (N)	1.1 =(1 yr., 1 mo.)	21.2%	1.5	28%
Highest Gain (N)	2.5	28%	1.8	31%
Average % Imp. (R)	2.7	33%	2.3	21%
Highest Gain (R)	2.9	63%	1.4	13%
NEP				
Average % Imp. (N)	1.6	18%	1.2	11%
Highest Gain (N)	1.8	49%	1.7	12%
Average % Imp. (R)	1.75	23%	1.9	26%
Highest Gain (R)	2.1	30%	2.5	31%
LEP				
Average % Imp. (N)	1.0	14%	1.8	29%
Highest Gain (N)	1.5	48%	2.6	43%
Average % Imp. (R)	.9	10%	1.5	25%
Highest Gain (R)	2.8	32%	3.3	50%
ECIA				
Average % Imp. (N)	3.1	68%	3.2	56%
Highest Gain (N)	5.3	90%	4.1	90%
Average % Imp. (R)	4.0	56%	3.0	88%
Highest Gain (R)	4.9	73%	4.3	84%

Most of the children returned to the program the second year did complete the program (the 10 phases and the games) by the end of the school year. If they received 50% or more on the CAT (California Achievement Test) and had been placed in the Title I program (ECIA) they no longer were scheduled in the center for more remediation (at least not for Reading and Writing). The EMR classrooms were added this year, consequently very few children completed the program. They will, however, be tested at the beginning of the '84-'85 school year on the mastery test for the phases completed; review and drill will be provided for those phases they had trouble with, before moving on to the next phase. This group of students did exceptionally well for the time spent in the program.

At the end of the '83-'84 school year, there were 14 new children who were "Tested Out" of the program because they had passed 50% in the CAT although they may not have completed all 10 phases of the program. In the group were 6 children classified as LEP (Limited English Proficiency), 1 Bilingual child, and 7 children with FEP (Faulty English Proficiency).

Tested Out of Program

WRAT

Student Classification	Reading Gr. Equiv. Imp.	Reading % Imp.	Spelling Gr. Equiv. Imp.	Spelling % Imp.
LEP				
Average % Imp.	1.6	23%	6.0	27%
Highest Gain	4.2	39%	4.6	68%
FEP				
Average % Imp.	3.7	79%	.7	53%
Highest Gain	4.5	79%	6.7	84%
1 Bilingual Child	4.9	29%	5.0	27%

Why It Works So Well with the Handicapped

Suggestions and instructional recommendations, for learning disabilities and reading, have been gained from recent research.

1) Because the L.D. learner is inattentive, inactive, and unable to spontaneously generate appropriate learning strategies, remedial goals include inclusion of the learner in both selection and use of learning strategies. The body of research in teacher effectiveness suggests that direct instruction may be an appropriate technology for facilitating achievement with learning disabled children. While most of the teacher effectiveness research has focused on regular education rather than Special Education, an attempt was made to relate these findings to educational interventions for handicapped learners. It was suggested that effective instruction is individualized, directed and academically focused. The "Writing to Read Program" provides this individualization. Children work at their own pace. The instructional approach derived from the teacher effectiveness literature is called direct instruction. Direct instruction can be defined as a set of teaching behaviors which attempts to maximize student attention and participation in academic relevant tasks. One important aspect of direct instruction is the relationship of engaged (or academic) learning time to allocated learning time and student engagement. Student learning is related to time on task. The engagement of the student in the learning task, thus, becomes a major goal of instruction. The learning environment is structured to bring this about.

It is unlikely that large group instruction can adequately respond to the diverse learning needs and the variations in learning rate inherent in the learning disabled population. The computer-based "Writing to Read" program provides directed instruction and allows each child to move at his rate of learning. Computers are "patient."

2) Direct teaching occurs when the instructor demonstrates, models, defines, and explains.

3) Several studies of instruction with learning disabled students support

direct teaching. One study reported a gain of three years in three months for a reading disabled adult in a direct instruction phonics program; training focused on the phonics/phonemic skills the individual had not yet acquired.

"Writing to Read" demonstrates, models, defines and explains. It also teaches the 42 phonemes of English and the sound/symbol relationship of these phonemes.

4) The research of the last decade favors early emphasis in decoding rather than comprehension. While the bulk of the research has taken place in regular classrooms, it would appear that a code-emphasis approach in beginning reading would also benefit learning disabled. The encoding (the writing) to decoding (reading) approach of "Writing to Read" provides this emphasis.

5) Students must focus on the relevant features of the learning task. This is particularly true for students characterized by poor attention and distractibility. The opportunity to work with the computer certainly motivates the student and holds his attention.

6) Skill acquisition is not complete until skills can be performed quickly and accurately. We must provide opportunities for supervised practice. "Writing to Read" provides the practice required to allow the child to respond both quickly and accurately. The practice is provided in a variety of situations. Another important dimension of practice is the number of practice opportunities offered to the child by the program.

Comments From Teachers and Others

At the last meeting of the year, May '84, teachers and other had a good time discussing the program.

The program was very successful for many reasons. Some of the positive aspects of the program as discussed and mentioned by those at the meeting were:

1. The multi-sensory approach to the English Language: hear the word, say the word, see the word and write the word. Use of all modes of learning: hearing, seeing, touching, and talking.
2. The repetition approach to the lesson aided memory skills.
3. Change of activities from one center to the next.
4. Positive reinforcement.
5. Self-pacing of students.
6. Use of typing for those with small muscle coordination problems.
7. Listening skills are reinforced.
8. The patience of the computer.
9. The orderly transition from one step to the next.
10. The journals provide a place to write words, sentences and stories and provide vocabulary skills.
11. Listening to the stories written by the children and input from the teacher on various subjects for each lesson improved language and vocabulary skills.
12. Typing stories or sentences on the computer and printing them out was an exciting tool to learning. The students were delighted at the fact they could read their printed words to peers, teachers, and parents.
13. Many of the learning handicapped children have concentration problems (short attention span). They also have a difficult time following directions, but they could not argue with the computer when it told them to do something. Many finally learned that excuses no longer worked.

14. The Special Education Resource Teacher must develop an IEP (Individual Educational Plan) for each student. This leads to concentration on certain areas of instruction. The Writing to Read Program became a part of the IEP and reinforced the phonics program.
15. Another interesting aspect of the program was the student's capacity to see phonemic spelling of words and then recognize the actual spelling and being able to spell them correctly.
16. The students enjoyed writing on the computer because they could correct all of their errors and have a perfect product. It was especially good for proof-reading their own work, which they often dislike doing.
17. The program encouraged vocabulary building in many ways at all levels. The second and third grade children were asked to think of some more rhyming words for the new words from the "Make Word" pages, and write them. Fourth, fifth, and sixth grade students were required to find as many rhyming words as possible by using a dictionary. Fish is a word introduced in Phase I to introduce the sound represented by "f", "i" and "sh." The children came up with a large number of words such as accomplish, radish, as in rhyming words. In story writing, the older children were required to write at least a three paragraph story using the three words introduced in that phase. They had to be very imaginative to work some of the words together; some of the older students really got into the story writing and this extended over to their classroom writing.
18. The program provided more time for the teacher to give attention to those children with learning problems and disabilities, to plan stimulating activities, and to encourage language skills. It gives the children an opportunity to write of their own personal experiences, and to share stories with others.

One school's staff indicated: "We are pleased to have been a part of the 'Writing to Read' pilot program, study. It is a learning tool in our learning center. Contingent upon funding, we plan to increase the number of IBM computers and Writing to Read software to accommodate more students. The 'Writing to Read' program has provided our participating students with reading and language experiences and has aided in many students being 'tested out' of the ECIA, Chapter I, program by increasing their CAT scores in Reading Above 50%."

Recommendations

We would like to see the W.T.R. program expand to better serve the intermediate students. Such expansion might include a journal using more difficult words and pictures. We feel intermediate students need the phonetic approach to reading as well as seeing their stories in print.

A word processor for elementary students would be a tool well worth adding to the W.T.R. program. The typewriters did not work well for some elementary students because of their lack of typing skills. The word processor would enable the student to immediately correct mistakes and print a perfect copy!

In conclusion, we would like to see this program extended to more words and groups of words for advanced students. I appreciate having the use of it this year and am looking forward to using it next year.

AN OBSERVATION CHECKLIST FOR POSSIBLE PROBLEMS WITH VISUAL-MOTOR SKILLS AND AUDITORY SKILLS

Name of Student____________________ Age: years________ months______

Name of Observer____________________ Date of Observation____________

SYMPTOMS OF POSSIBLE VISUAL-MOTOR PROBLEMS

	Generally	Sometimes
1. Does the student have difficulty catching, throwing, or batting a ball?		
2. Does the student have difficulty putting block designs together?		
3. Does the student have difficulty reproducing geometric shapes (e.g., a circle or square)?		
4. Does the student have difficulty writing or drawing in limited space (e.g., writing on lined paper)?		
5. Does the student assume an unusual head or body position when working at a desk?		
6. Does the student seem to confuse numbers, letters, or words that are similar in configuration?		
7. Does the student have difficulty putting a cartoon in sequence?		
8. Does the student make reversals of letters, numbers, or words while writing?		

SYMPTOMS OF POSSIBLE PROBLEMS WITH AUDITORY SKILLS

1. Does the student have difficulty repeating three to five digits in correct sequence?		
2. Does the student omit or substitute sounds in words?		
3. Does the student have difficulty following directions given to a group?		
4. Does the student request repetition of phrases or words?		
5. Does the student have difficulty distinguishing rhyming words?		
6. Does the student fail to identify common environmental sounds (e.g., sound of motorcycle or doorbell)?		
7. Does the student watch others to find what to do?		
8. Does the student continue to have difficulty with elementary phonics such as initial, medial, and final sounds?		

SCORING CRITERIA ARE AS FOLLOWS:

Visual-Motor Skills

"Generally" Responses X 2 = ________

"Sometimes" Responses X 1 = ________

Total Responses = ________

Auditory Skills

"Generally" Responses X 2 = ________

"Sometimes" Responses X 1 = ________

Total Responses = ________

AN OBSERVATION CHECKLIST FOR POSSIBLE PROBLEMS IN LANGUAGE AND INTELLECTUAL DEVELOPMENT
(Cognitive Domain)

Name of Student ______________________ Age: years_______ months_______

Name of Observer ______________________ Date of Observation ____________

SYMPTOMS OF POSSIBLE PROBLEMS

	Generally	Sometimes
1. Does the student express vague and confused ideas?		
2. Does the student have difficulty comprehending actions and speech of others?		
3. Does the student have difficulty following simple directions?		
4. Does the student display inaccurate enunciation and/or pronunciation?		
5. Does the student fail to use new words in conversation and communication?		
6. Does the student fail to remember a sequence of events?		
7. Does the student speak only in short sentences?		
8. Does the student have difficulty categorizing and classifying (e.g., coat and gloves as clothing or drill and jigsaw as tools)?		
9. Does the student refuse to use language or speech?		
10. Does the student insist upon using gestures and body language?		
11 Does the student have difficulty telling a story about an illustration or filmstrip?		

SCORING CRITERIA ARE AS FOLLOWS:

"Generally" Responses X 2 = __________

"Sometimes" Responses X 1 = __________

Total Responses = __________

A MODIFIED OPTACON: TOWARDS AN EDUCATIONAL PROGRAM

PAUL BACH-Y-RITA
BARRY HUGHES

ABSTRACT

Persons blind from birth or blinded at an early age do not develop strictly visual concepts of a three-dimensional space. This results in both developmental delays and longer term cognitive and perceptual alterations in their spatial cognition of the objects that populate space, even their personal self-representation. This research is designed to develop an educational application of the already demonstrated capacity of the human tactile sensory system to mediate three dimensional, spatial information, which, in sighted persons, is carried by the visual system. We seek to demonstrate that, with an inexpensive modification to a commercially available and widely used optical-to-tactile conversation system, Telesensory Systems' Optacon, blind children can develop a richer spatial cognition and self-representation based on heretofore unavailable visual information. The research has several specific aims: develop visual spatial concepts, to work with educators of the visually impaired, and to introduce this program into an educational setting.

In a recent discussion of the long-range feasibility of sensory substitution systems in rehabilitation (Bach-y-Rita, 1983), two key points were advanced. The first is that the most successful sensory substitution systems (Braille, sign language and the long cane) share several common factors. Among these are the absence of complex instrumentation, high reliability, and appropriate transduction of one type of sensory information into another. With these systems, the sensory system that carries the information to the brain is not overwhelmed; information processing occurs in a form and rate consistent with the brain's physiological capacities and limitation. Each of the three sensory substitution systems also has limitations. In particular, each is capable of transmitting to the brain only a limited range of environmental information. Braille readers, for example, can read only limited literature. Long cane users cannot perceive overhangs nor can they gather information about the space in front of the cane tip. As a consequence of being deprived of sensory information, and therefore, being unable to perceptually experience some aspects of their world, a blind child is at a significant developmental disadvantage. Some basic visiospatial knowledge was simply beyond their experience or understanding. Consider, for example, the following passage from Lowenfeld (1955) on some of the perceptual difficulties facing the blind:

> "The sun, the moon, the clouds, the horizon, the sky are inaccessible and can be explained to blind people only by the use of analogies from other

> sensory fields. This method must also be used in explaining to blind people such visual phenomena as shadows, perspective, and reflection of light. Many objects are too large to be observed by touch; for instance, a mountain or a large building. Other objects are too small and cannot be observed by touch with any degree of accuracy; for instance, flies or ants."

Self-representation is an especially important cognitive acquisition because it has many other ramifications for the representation of objects in the environment. Self-as-object, for example, is important because it is "the leading edge of a number of other aspects of self-identification," such as the usage of 'I' in language and play.

For the sighted, vision contributes a disproportionate amount of information useful in motor control, spatial cognition and the construction of self-image. This information is normally beyond the processing characteristics of the haptic or auditory modalities. The blind child's delay in the acquisition of 'I'-as-a-concept, for example, can be related to the problems of constructing a self-image in the absence of vision.

> "The blind child has no sensory mode available to him which will replicate his own body or body parts. The blind child is obliged to constitute a body image from the components of non-visual experience available to him...but these sensory modes bind him to egocentric body and self-experience and cannot lead him easily to the concept of self in which the self can be taken as an object, the indispensable condition of 'I'. (Fraiberg & Adelson, 1976:145)

It is our contention that the problem of such children is not the absence of sight, but rather an absence of a means by which visual information can be perceived. The modified Optacon, we argue, is capable of providing visual information through the skin; it produces a perceptual system that Fraiberg and Adelson (1976) felt could not be duplicated without vision. It does simulate vision in a number of important ways: representing particular objects in their entirety, extending out beyond the reach of the observer, and reducing the need for gross tactual exploration.

While not capable of processing information as simultaneously as the visual system, the tactile presentations through the Optacon offers numerous advantages over strictly haptic or kinesthetic presentations. The latter require the synthesis of sequentially processed information which places a heavy load on memory and other cognitive processes (e.g., a face haptically explored cannot result in the immediate representation of a face: perhaps the outline is perceived first, then the hair length, then the nose, etc. Each part must be perceived, then remembered and then synthesized into a representation of a face, or with more difficulty, into one particular face). Not only is this a considerably demanding task, but it is also limited, even with practice. The Modified Optacon can relieve the user of some of this cognitive burden: certain objects can be presented *in toto* (even if not in great detail), and without the necessity of sequential touching, or even touching at all.

The kinds of experiences discussed in the beginning are precisely those that have already been provided blind subjects in the earlier TVSS research (see Bach-y-Rita, 1972; 1980 for details). The provision of visual information via a different sensory modality offers the *opportunity* for the young blind subject to develop those cognitive concepts vital for spatial cognition, perceptual-motor skills, self-representation, and self-image. To reiterate, it is by no means clear that *only* sight can offer useful visual information. In fact, our research with the modified Optacon suggests that some quasivisual information *can* be made available and that certain entirely novel experiences (such as the tactile image of a flickering flame) can be perceived. It remains to be seen, of course, whether the perceptual experiences offered by the modified Optacon can have identifiable *long-term* developmental benefits. The *modified* Optacon, we propose, can provide or supplement the blind child's experience, useful in the development of self-representation in various ways: as a detached *observer* (rather than just an active *manipulator*) of objects in space, as a continuous physical *entity* (that is, as a complete object in space), and as an *actor*. Further, the proposed Optacon program offers the opportunity for the child to view him/herself as others do, so that he/she may be provided a means to reduce the anxiety associated with physical appearance.

Basic research on the means by which the visually impaired code vibrotactile information about shape, distance, location, orientation, etc. is also necessary in this endeavor because there remains considerable confusion in the literature as to the relative performance of the sighted and blind in spatial tasks. Is vision a necessary or a sufficient, or merely facilitating aspect of spatial performance? How does the memory of objects only touched compare with that for objects only seen? To what extent are differences in sighted and blind performance attributable to the amount or the type of information provided by vision and touch?

Evidence for poorer (or even different) performance by the blind on certain spatial tasks is usually interpreted as evidence for the necessity of vision in such cognitive-conceptual development, and for the separateness of the different sensory systems. The absence of visual information severely limits the subjects' knowledge of external (tactually unperceivable) relations among objects: "the congenitally totally blind lack important aspects of information, and forms of organizing it that are easily derived from vision" (Millar, 1981:310). The modified Optacon offers one means by which this scope and type of spatial information can be made available to the blind, and deprived spatial representations assessed.

Backround Research

Studies with Tactile Vision Substitution System (TVSS), which form the background for the present proposal, emerged from concepts of brain plasticity and the potential for one sensory system to substitute for another (e.g., Bach-y-Rita, 1972). The TVSS is a system for converting an optical image into a tactile display. After surprisingly little training, subjects are able to recognize common objects and to describe their arrangement in three-dimensional space. By control of the sensing and imaging device, a television camera, subjects quickly made distal attributions (i.e., understood patterns as belonging to objects localized out in space, and not just against the skin).

In order to deliver the image picked by a TV camera (under the control of the blind person) to the skin of the trunk, each point stimulated on the skin represented one small area of the image captured by the camera (much as a newspaper photograph represents a scene by an array of dots). A functional 400-point system (20 x 20 matrix in contact with a 10-inch square of skin) was completed in 1968 (Collins, 1970). More than 80 blind persons were trained or tested, of whom, 30 received more than 40 hours of training.

Learning the techniques of camera manipulation usually occupied the major portion of the first few hours of training. This included controlling the zoom lens operation, aperture and focus, as well as directing the camera to some part of the surround. With this self-induced camera movement, subjects used the camera as part of a perceptual organ.

The visual analysis techniques and concepts thus developed were used in letter recognition, the perception of moving stimuli, and the exploration of other persons standing before a camera and the exploration of the subject himself in a mirror. Our subjects learned to discriminate between individuals, to determine where they were in the room, and to describe their posture, movements, and individual characteristics. However, detail, such as found in a photograph of a face, was particularly difficult to perceive.

We developed several portable models of the TVSS which use an array of mechanical or electrical stimulators applied to the skin of the abdomen. Subjects wore a small TV camera mounted on the frame of a pair of glasses, and a vest containing the electronics and batteries. Field testing of the TVSS for a limited industrial task was also conducted in collaboration with an electronics company. A blind technician was trained in the assembly of solid-state diodes, a high-volume task normally performed by sighted employees. After three months, he was able to perform the assembly line microassembly and inspection tasks with comparable speed and accuracy as sighted persons.

The Modified Optacon

The standard Optacon consists of a matrix of photocells and a corresponding matrix of skin stimulators. The blind person passes the matrix of photocells across the lines of print on a page and receives the output on a stimulus array of 144 (24 x 6) piezo-electric driven vibrating tips on the fingertip (Linvill and Bliss, 1971). The modifications we have applied to it are quite simple: following the deactivation of the camera's internal light source, we have fitted, above the reading aperture, an adjustable telescopic tube and inexpensive biconvex lenses of varying diameter and focal length (ranging from 11mm x 20mm x 20mm x 35mm). Figure 1 illustrates this arrangement.

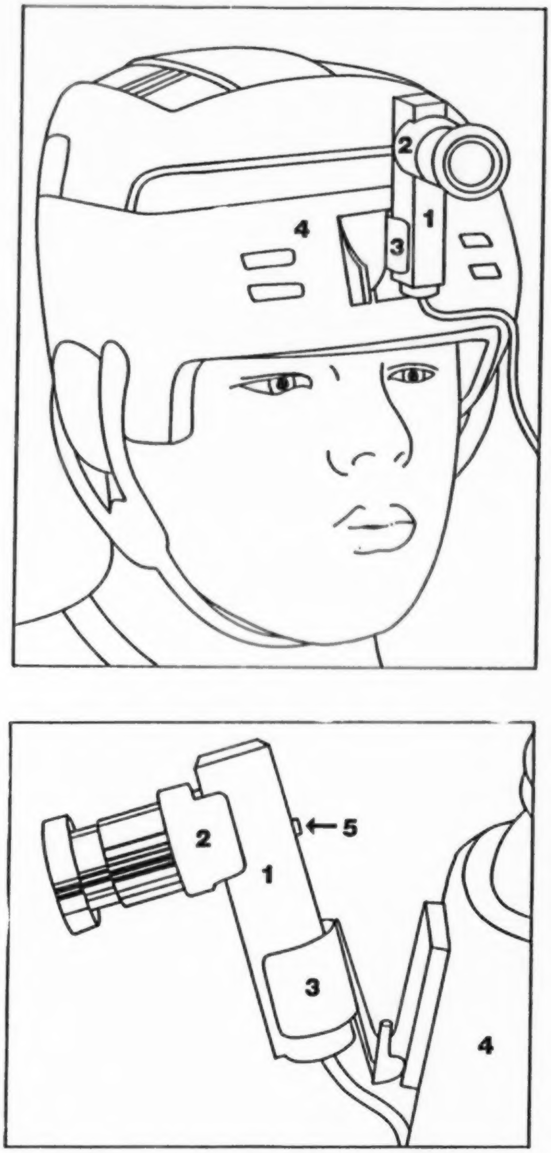

Figure 1. The standard optacon (1) modified by fitting an adjustable lens attachment (2) and angle-adjustable clasp (3) to a lightweight headpiece. Zoom adjustment is (5).

In order to provide maximal mobility in the scanning of the camera, we have permitted it to be hand held, to be mounted on an adjustable tripod, or to be mounted on a light-weight helmet or cap where it can be moved via head movements. Our primary objective in the earliest pilot work with four early-blind students (ranging in age from 13 to 28) has been to replicate as many of the effects documented in the TVSS research as possible and to develop a systematic teaching program based on this work. The learning results found so far have been positive: one of the subjects, who owns his own Optacon, learned, with eight hours of practice, to accurately identify the three-dimensional shape of a rotating wire mobile, to state its direction of rotation, and to use other monocular cues to depth perception. The other subjects who had minimal previous experience with the Optacon, progressed to the same level, but at a slightly slower rate.

The training program, as it now stands, is based on the earlier TVSS approach. What follows is a brief outline of the basic task domains on which we have based the program.

Perceptual-Motor Interactions

The modified arrangement makes substantial use of active movement on the part of the user. However, while standard operation of the Optacon is limited to linear scanning along a printed line, use of the modified Optacon requires far more varied motor involvement in different directions, over different extents, and often in an exploratory non-predictive way. learning to scan in two dimensions, learning to stabilize images, learning to reliably and accurately distinguish movement of objects in the perceptual field from movements of self is needed.

Distal attribution, a term signifying the user's ability to attribute the (changes in) stimulation at the finger tip to (changes in) distal objects located in the functional perceptual field, is constantly encouraged with verbal reminders and haptic confirmation. Accurate scanning of the perceptual field, with emphasis on the zoom and threshold manipulations, is also vital, given the narrowness of that field. Novices may also require explanation of why, with movement to the right (e.g.), the image moves to the left, and an opportunity to become familiar with this.

Much of this aspect of the curriculum parallels that is used in the standard Optacon approach, except that we use more variety in line length, width and orientation, and require that users continually make comparative perceptual and memorial judgments in practically every exercise. In scanning lines we emphasize image stability. We also include active movements by the user to correct body position, to rectify the line orientation, (e.g., if a line is supposed to be vertical but is not displayed as such on the monitor, it must be because the subject's head is tilted). This can also be used to demonstrate how a line will change its apparent orientation with a purposeful head tilt, and again, how a change in object orientation can be distinguished from head orientation. We use both straight and curved lines. This work eventually leads to the ability to distinguish the perceptual effects of self-movement from those of object movement.

The same objectives are apparent with more than one line present in the visual field: that is, we seek to have the user scan accurately, distinguish and correct for line orientations, as well as make comparisons between the geometric characteristics of the lines. For example, we ask questions regarding relative straightness of the lines, relative lengths, widths, and orientation; whether or not the lines are parallel; whether they connect, and/or intersect and, if so, at what approximate angle; and whether they form familiar patterns or alphanumeric characters. The ability of the users to comprehend such terms is relevant, but it should also be recognized that such exercises may provide valuable practice with such terminology by a means which is perhaps more useful than the normal verbal descriptions and haptic exploration.

The gradual introduction of more complicated patterns can continue with the presentation of two-dimensional shapes. These can take the form of alphanumeric characters that may already have been learned by Optacon reading, and of other symbolic images.

Three Dimensional Objects

Learning monocular cues to size and depth is the most time consuming exercise of all, but could offer the most long-term benefits. Depth perception, after all, is one of psychology's and art's classic problems; even the sighted are faced with this problem because the very nature of the visual system involves a three-dimensional world translated onto a two-dimensional retinal surface. An understanding of how we perceive an object as being a certain constant size even though it may be moving toward or away from us, or of how we see a set of objects arranged in depth, requires an understanding not so much of the visual system but of the kinds of information, 'cues' to depth we learn to use. We define a depth cue as a pattern of proximal stimulation (in this case, the vibrotactile pattern from the Optacon) that contains information about the (three-dimensional) spatial locations of distal objects.

The following topics constitute our work in this area:

(1) Interposition: how one object can occlude, or partially occlude, another when both are in the projected line of 'sight' of the Optacon.
(2) Linear perspective: how, for example, parallel lines appear to converge as they recede in depth.
(3) Relative size: how an object, which maintains its true size, subtends a greater visual angle and hence appears larger as it approaches the 'viewer'.
(4) Motion parallax: how self-movement changes one's perspective of objects or object relationships.
(5) Effects of object motion: how objects undergo changes in perspective as they move (e.g., rotate).

Supplementary Uses

In addition to offering a means by which visuo-spatial information can be presented to blind users, our hope is that other educational benefits may be derivable from use of the motified Optacon. The following is a partial list of some possibilities we have already attempted:

(1) Pictorial Representation of Illustrations: Much of what is presented in print is supplemented with pictures, photographs or drawings. If the material is considered essential from an educational perspective, it must be converted to a tactual format (i.e., geometric figures, maps, etc.). This requires considerable hours of additional effort. If, however, a simplified representation of the picture could be viewed with the modified Optacon, much of this time and effort could be saved. The information would be elemental, but still convey the main idea in a succinct, time saving manner.

(2) Large-Scale Information: Here the need is to present scaled room, building, and travel route information in a manner that is efficient to both the modified Optacon user and the information provider.

(3) Daily Living Skills: Here

the emphasis would be on specific skills: The information provided would allow the user to either better replicate a function, understand an action or layout, or perceive the whole of a subject being discussed.

(4) Signature Development: The opportunity to observe and compare one's own handwriting is important. For the user to produce his/her signature and then contrast it, would be a significant advancement. With the modified Optacon, performance feedback can be immediate and the user's improvement can be self-monitored.

(5) Motion: The concept of movement is a difficult one to grasp. The modified Optacon provides an opportunity for the user to perceive motion without interfering with it. This is in itself a significant opportunity. That it could be applied to the live illustration of, for example, laws of physics for academic purposes, would be of real value.

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ESTABLISHING A COMPUTER NETWORK FOR CONNECTICUT

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TOM B. GILLUNG

ABSTRACT

This presentation
activities of the Conne
Education Computer Ne
(ConnNET). The overall
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to provide a positive
quality of programs delivered to handicapped children. To ensure that this occurs, the project will develop a Connecticut bulletin board on SpecialNet, develop and disseminate a Connecticut SpecialNet handbook, stimulate statewide interest in SpecialNet, evaluate telecommunications equipment needs of school districts, select school districts for SpecialNet subscriptions and training, train local school district and State Department staff in SpecialNet, and develop a technical assistance plan for the state to use in continuing the Connecticut Special Education Computer Network.

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districts have micro-
able at the elementary
levels, and 62 percent
of the district have them available at the high school level (Glass).

More recently, a Connecticut needs assessment conducted by Connecticut Special Education Network for Software Evaluation (ConnSENSE) reveals that 87 percent of the school districts responding have one or more computers available for use by special education students. Of those districts, 76 percent have one or more Apples, 39 percent have one or more Radio Shacks, and 26 percent have one or more Commodores. While these figures are encouraging, some districts have only a few computers available for the entire system while others have over 200 and still other districts have no computers available for either instruction or management uses.

The ConnSENSE needs assessment revealed some other interesting facts. Microcomputers are now being most used for computer assisted instruction (63%) and word processing (43%). The respondents feel that in the future they would like to use microcomputers more for IEP development (60%), record keeping (57%), budgeting

(38%), and SpecialNet (32%) (a national special education computer network). When asked to suggest topics for future issues of the ConnSENSE Bulletin, 43 percent of the respondents suggested the topic of networking. Thus, while we are beginning to see computers used more often for special education instruction, we also see a definite interest in, and a need for, more administrative applications of computers and computer networking. This latter issue, the interest in computer networking, is the focus of the ConnNET project.

Project Design

General Design

The overall goal of this project is to develop and field test a special education computer network with schools and school districts in Connecticut. SpecialNet will be used as the means to achieve this goal. The realization of this goal should enhance communications among schools and between the State Department and local school districts to such a degree that it will have positive effects on the quality of programs for handicapped children in Connecticut. To achieve this overall goal, the project will develop a Connecticut bulletin board on SpecialNet, develop and disseminate a Connecticut SpecialNet handbook, stimulate statewide interest in SpecialNet, evaluate equipment needs of school districts, select school districts for SpecialNet subscriptions and training, train local school district and State Department staff in SpecialNet, and develop a technical assistance plan for the State to use in continuing ConnNET activities.

Implement a Connecticut Bulletin Board on SpecialNet

The first activity is to implement a SpecialNet bulletin board for Connecticut. As this should provide an added incentive for Connecticut school districts to join SpecialNet, work relating to this activity began as soon as the project was funded. Joining SpecialNet opens a vast national information base to the local school districts. The Connecticut bulletin board will provide the opportunity for instant communications between Connecticut school districts and the State Department of Education, as well as among the districts themselves. The Connecticut bulletin board will function like a State Department of Education electronic newsletter. Information of particular importance to Connecticut special education administrators will be "on line" instantly. It will also provide a vehicle for educational leaders to exchange ideas on pertinent issues and, as such, it will be a powerful communication medium.

SpecialNet recommends several steps for setting up a statewide bulletin board: (a) identify the audience, (b) outline the information base, (c) decide on the type of bulletin board, and (d) arrange for the administration of the board.

Identify Audience. The general audience for the ConnNet Project consists of the State Department of Education, all Connecticut local school districts, private schools and centers of various types, regional education service centers (RESCs), the Connecticut Special Education Resource Center (SERC), and colleges and universities across the State. The primary audience for this phase of the project will be the local school districts and the State Department of Education. We will select at least 30 local school districts for subscriptions to SpecialNet. The selection process is explained below.

Information Base. The Connecticut bulletin board will begin as an all purpose board. That is, this board will contain a wide variety of topics rather than concentrate on a single theme. In time, a second or third bulletin board might be added.

Examples of items added by the

project might include:

- State Department of Education memos
- New State policy/procedures
- State Department budget updates
- Status of bills in the State Legislature
- Promising practices within the state
- Notice of meetings/conferences
- Lists of resources in various locations
- Recommended special Education courseware
- Recommended management software

Local school districts might also add items in the categories listed above as well as the following:

- Examples of successful administrative strategies
- Position Announcements
- Requests for information
- Requests for technical assistance

It is important to note that ConnNET, State Department, and local school district staffs may contribute information under any of these categories, or others as deemed important.

Type of Bulletin Board. A bulletin board can be "open" so that any SpecialNet user can access it and add items to it, open only to Connecticut users, or closed so that information can only be added by the project staff. The ConnNET staff and SpecialNet consultants from National Systems Management, Inc. (NSMI) believe that the bulletin board should be open, at least at this point, to encourage the greatest number of users and contributions.

Administration of Bulletin Board. The project, as described below, will train State Department personnel in the use of SpecialNet, and provide technical assistance and training so that when the project concludes the State Department will be able to administer the network. However, to start, the bulletin board will be administered by the ConnNET staff at the University of Connecticut. The University will provide an Apple IIe microcomputer with two disk drives and a monitor, plus a Novation 212 AppleCat Modem. The project staff will work in very close cooperation with the State Department, since much of the bulletin board content will emanate from Hartford.

Develop a Connecticut SpecialNet Handbook

After several discussions with Gary Snodgrass, President of NSMI, it was decided that to develop a SpecialNet handbook unique to Connecticut would be both unnecessary and overly costly. Instead, the project will use the handbook that Mr. Snodgrass and his staff have already developed and used successfully in several states. Naturally, we plan to modify this document to meet the specific needs of Connecticut and this project. In particular, we will include an up-to-date listing of Connecticut SpecialNet users and a description of policies regarding the use of the Connecticut bulletin board. The project staff will supply these unique aspects and will purchase the SpecialNet handbook from NSMI for use in the project.

Stimulate Statewide Interest in SpecialNET

The ConnSENSE project has encouraged Connecticut school districts to subscribe to SpecialNet. When ConnSENSE joined SpecialNet the only other subcribers were the Bureau of Student Services and one of the Regional Education Services Centers. As of August, 1984, a total of seven agencies have joined SpecialNet, and others are considering this option. In fact, 32 percent of the respondents to the ConnSENSE computer needs assessment felt that they would like to join SpecialNet in the future. There is interest in SpecialNet, but this interest needs to be stimulated. The ConnNet project should do that by providing SpecialNet subscriptions to at least 30 Connecticut school districts. Further, the project will train personnel from these school districts, the State Department, and others in the use of SpecialNET.

The ConnNET project was announced during the summer of 1984 in the ConnSENSE Bulletin and at "ConnSENSE '84," a one day conference for special educators held on July 18, 1984, at the University of Connecticut. Also, it will be announced soon in a Connecticut Special Education Resource Center (SERC) mailing. Past experience has shown that a SERC mailing is likely to generate enormous support for such a project. The Bulletin goes out to over 900 special educators interested in computers and special education, including all special education administrators. This represents one of the largest computer user groups in Connecticut.

Evaluate Equipment Needs

A telecommunications equipment questionnaire will be sent out to all interested school districts. The questionnaire is designed to determine equipment needs to enable the schools to link to SpecialNet. The questionnaire will be returned to ConnNet and analyzed by the NSMI staff. Individual recommendations for each school district will be made in terms of the most appropriate and cost effective way to join the Network. This analysis will be completed before the first training session so that the results can be discussed with the participants at that time.

Select School Districts

We believe that project publicity will generate a sufficient number of potential subscribers to SpecialNet. The project will develop a mechanism for selecting school districts in a fair and equitable manner. These selection criteria will be determined by an advisory committee. Besides the ConnNET staff, this committee will be made up of the State Department of Education project officer, a representative of the Connecticut Association of Supervisors of Instruction in Special Education (CASISE), the Connecticut Association of Pupil Personnel Administrators (CAPPA), a Regional Education Service Center, SERC, and a Special Education Teacher.

Train School District and State Department Staffs

The project will train staff members from the selected school districts, plus designated State Department of Education personnel. In addition to the primary group of 30 school districts selected for this project, school districts that have joined SpecialNet in other ways will also be eligible for training.

The training sessions will be conducted in conjunction with National Systems Management, Inc. of Washington, D.C. NSMI, which operates the SpecialNet system, has conducted similar training in several states with success. The ConnNET staff will work closely with NSMI and make all the arrangements for the workshops.

There will be three separate training sessions for all users corresponding roughly to beginning, intermediate, and advanced training. These will be spaced appropriately to allow users time to practice their skills between sessions.

The remainder of this section contains a brief description of the training. Since the major focus of this project is telecommunications, or computer networking, electronic mail, and electronic bulletin boards, it seemed only fitting to use such technology in developing this paper. What follows was relayed via SpecialNet form NSMI in Washington, D.C. to the project staff at the University of Connecticut. It was down loaded into the memory of the project modem, read into an Applewriter file, modified slightly and then relayed via telephone lines to the University mainframe and into this paper.

NSMI has considerable experience in providing training for SpecialNet users. Over a period of three years, NSMI has conducted hundreds of training sessions in every part of the United States, including training in Alaska, Hawaii and the Virgin Islands. A full-time Director of Training is employed to provide this service. The Director of Training calls upon NSMI technical and professional staff to assist in the provision of very high quality on-site training programs. Slide presentations, overhead transparencies and video tapes have been developed to make the training sessions informative and entertaining.

Training is divided into three parts:

- Orientation & Beginning Training
- Intermediate Training
- Advanced Training

SpecialNet is very easy to use. In fact, most system users are self-trained. However, we have found that formal training helps to assure effective, cost-efficient system utilization. Self-Training manuals are provided for each user. These include:

- Introduction to SpecialNet: Basic User Training
- Introduction to SpecialNet: Advanced User Training
- Introduction to SpecialNet: Editing
- Quick Reference Card

Orientation and Beginning Training

The full day orientation and beginning training session is devoted to developing an understanding of the communication network. It covers system capabilities, equipment procurements, and potential applications from a laymen's perspective. As described above, a questionnaire designed to determine equipment needs or modifications to existing equipment is distributed to participants before the meeting. The questionnaire will be completed and analyzed by NSMI prior to the meeting, so that any recommendations for equipment modifications can be developed and discussed with participants during the meeting.

Intermediate Training

The Intermediate training usually occurs approximately 6-8 weeks after the Beginning training. This allows users time to practice as well as become familiar with the electronic mail system. It is important, though, not to let too much time lapse between the two sessions or users may become frustrated by not having the opportunity to deal with questions or problems.

Advanced Training

The advanced training is suggested for SpecialNet users with microcomputers or word processors. The focus of this session will be on down loading of text from SpecialNet Bulletin Boards as well as batch sending of messages.

Develop a Technical Assistance Plan for the State

The Connecticut bulletin board will provide the major vehicle for the state to provide technical assistance to local school districts. In addition to technical information provided in the bulletin board, users will be able to correspond directly with the state Department via SpecialNet. The ConnNET staff will develop a model for providing this technical assistance during the project, with the State Department assuming these responsibilities after the completion of this project.

Input for the technical assistance plan will come from the project staff, NSMI staff, and the project advisory committee. A draft of the plan will be written by the staff and reviewed by the advisory committee. Revisions will be made on the basis of this feedback and the plan will then be included in the final report.

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DEVELOPING A COMPUTER-BASED LEARNING TOOL FOR HANDICAPPED STUDENTS

JOHN J. JOSEPH

ABSTRACT

Innovative uses of computer technology can provide expanded learning opportunities for handicapped persons. Educators can take advantage of computer technologies without immersing themselves in it. This paper describes the development of one computer-based system which solved many classroom needs for both teachers and their handicapped students.

The promise of computer-based technology is often empty for handicapped persons. The very population that ought to benefit the most from new technologies is often bypassed. Economics of scale, high-priced "custom-built" devices, lack of in-depth understanding on the part of therapists, aides and instructors: these and other reasons stand in the way of handicapped computer users realizing the "high tech promise."

Historically, educators have been creative innovators. Desktop computers are becoming commonplace in classrooms across the United States. These computers do not come complete with solutions to all classroom problems. They do come with a potential for supporting the efforts of creative, innovative educators. Teachers must remember that they are the masters of their craft, teaching, and that these new machines are simply additional tools to serve in practicing that craft. Like any tool, they are most effective in the hands of practiced, expert craftspeople.

A Practical Problem

A learning laboratory at Fox Valley Technical Institute's Oshkosh, Wisconsin campus (FVTI-Oshkosh) is a focal point for building fundamental academic skills. Students use the lab to develop prerequisite skills for regular vocational or technical courses. These students are high school dropouts, adults returning to the classroom after extended absences, and handicapped students. All students follow a fairly structured schedule and, at any point in time, there may be from 2 to 20 of them in the lab. Goals are established for each student and appropriate materials are supplied for the students to master their objectives.

The lab instructor must cover a broad range of subjects within a broad range of comprehension levels. While the lab concept is based on individualized learning, there are many demands for teacher attention. Instructors coach students, maintain individual progress records, administer evaluations and supply materials for study and review.

When physically handicapped students are introduced to the learning lab, two distinct problems may arise: (1) if the student is severely handicapped, communication between instructor and student may be difficult and constrained. (2) Students may not be able to use normal methods to complete practice exercises and assignments. For example, for a student unable to use paper and pencil, it is difficult to demonstrate mastery of math concepts. The problem is exacerbated if the student is also unable to communicate verbally.

Teaching severely handicapped students requires constant, direct teacher-student interaction. Where student teacher ratios are 10:1 or lower, the required individual attention is available. In the learning lab described here, individual time is not available. If the teacher concentrates on communicating with the handicapped student, the remainder of the class may be ignored; handicapped learners may be unable to progress when the teacher is attending the rest of the class.

Developing a Model

During the 1983-84 school year, FVTI-Oshkosh staff began investigating the use of computers as aids for learning lab teachers. Initial discussions isolated handicapped students as the first priority for computer use.

Defining requirements was the first order of business. Three prime requirements surfaced immediately:

1. The system must not require delicate manual dexterity. (Student users should not have to to use a computer keyboard for input.)
2. The system should provide means for communication. (Student users should be able to participate in "conversation." They should have the ability to record messages for later use and review by printing output to demonstrate task mastery.)
3. The computer should assist handicapped students in completing assignments. (Mathematical capability is necessary for those students who cannot use pencil and paper.)

These early requirements were shaped in part by needs of existing handicapped students. The system which evolved was not intended to solve all learning/communication problems for all handicapped persons. At the time of early planning and goal setting, two handicapped students were using the learning lab. They were similar in several respects: both were male, in their early twenties, afflicted with cerebral palsy, confined to wheelchairs, and unable to speak. One student had earned a high school diploma, the other was working toward that degree. Although both students had fine motor control disabilities, one was more severely afflicted.

Differences in students' abilities to use their hands pointed up the need for a fourth criterion:

4. One system will not serve the needs of all users, even within the confines of a very small universe of users. (The computer system or systems must be flexible; it must be adaptable to a variety of skills and needs.)

Two additional criteria were added, related to the tools employed by any system to be implemented:

5. All hardware is commercially available at reasonable market prices (no premiums

for "handicapped" designations).

6. Required software to integrate the hardware functions is also commercially available at reasonable market prices or can be developed with minimal difficulty.

The six-criteria model that represented FVTI-Oshkosh requirements describes the attributes of a computer-based system for use in an educational setting. It was not intended to define a complete system for use by all handicapped persons with communicative disorders. Limitations built into the model were recognized and accepted.

Developing the Application System

Once the needs were defined, attention turned to development of the required computer system. Although similar systems did exist, there were none that met all the defined needs. No single piece of hardware was available that satisfied all the defined needs. The hardware finally assembled consisted of an Apple IIe computer, an Epson printer, a Power Pad (touch sensitive tablet), and Echo II (a speech synthesizer).

The integrating software programs were not available. Learning lab staff decided that custom programs should be developed--if development could be completed by outside programmers. A local software developer agreed to participate in the project, writing the software in return for design and testing assistance. Ownership of the resulting software is vested in the software development company.

Months of experimentation and development followed, during which the staff explored different layouts for the touch sensitive tablet and different functions for the user. Three application packages were finally installed. Two performed all functions outlined in the requirements. One served a single function. The basic difference between the applications was the size of the "keys" defined on the touch sensitive tablet. The three programs are:

1. The Speaker II Keys are 1 by 1 inch squares, with numeric, alphabetic, and special characters. All functions are accommodated. The operative portion of the touch sensitive pad is 12 to 9 inches.
2. The Speaker II Keys are 1-1/2 by 1-1/2 inches. Numbers, letters, and special characters are present. All functions are available. The entire pad is used.
3. Two-By-Two Keys are 2 by 2 inches. Only alphabetic characters are present. Only the speech synthesis function is available. The entire pad is used.

Implementing the Software

During the development phase, test versions of the programs were installed in the learning lab. The handicapped students tested the systems and suggested modifications. Student interest in the packages was high, but there was a danger that this was due to the novelty factor or the fact that they were receiving additional attention.

When testing was completed, user documentation was prepared and the final touch tablet templates prepared. The User Manual addresses two audiences: The system user and an assisting aide. Material addressed directly to the user defines the functions of the system and how to use them. Material directed to the aide describes necessary functions that the user may not be able to perform (setting up the system and using the computer keyboard, for example).

Evaluating Results

When the completed programs were installed in the learning lab, teachers carefully monitored the results. The first three model criteria were satisfied: student users could generate verbal and printed communication and complete math problems.

The hardware installed was, indeed, commercially available. The Apple IIe computer and the Epson Printer were the most expensive of the hardware items purchased. These components are usable in several other situations within the school, so the capital risk of installing the total system was minimized. (The touch sensitive tablet and speech synthesizer can also be used in other settings, but educational software for them is limited.)

Software programs were not available at the onset of the project; they were developed as part of the project. While FVTI-Oshkosh spent staff time, defining and testing the systems, they did not have to invest time and money required for program development. (The staff is also free of the ongoing maintenance tasks involved with computer software packages.)

Student achievement improved. The math portion of the programs allowed instructor verifiable calculation of problems. The printing capability accommodated preparation of student answers for instructor review. The speech synthesis function did, in fact, allow the nonverbal students to participate in conversation.

Most important, time on task increased significantly. The observations were subjective, but instructors concluded that improved performance was due to higher student motivation and increased time spent on learning tasks. An example may best illustrate this point. One of the students had developed a habit of taking a nap during the fifteen minute afternoon break. After he began working with The Speaker III, he stopped napping and continued work on his assignments during the break.

Conclusions

As a result of their experience with this software development, the FVTI-Oshkosh staff arrived at three significant conclusions.

First, computers can be effective tools for educators. Teachers must be willing to take charge of the computers in their classrooms, just as they control any of the other tools of their trade. Second, handicapped persons can adapt to and benefit from computer-based systems when the systems are designed appropriately to meet their needs.

Computer software programs do not exist to solve every conceivable need. Field developed programs are commonly believed to be the province of computer scientists and professional programmers. That is a myth. The final conclusion was that field development of computer-based systems which serve a particular group of needs is both possible and practical.

Computer based systems can have a positive impact on handicapped learners and expand the effectiveness of their instructors. The promise of computer technology is a step closer for handicapped persons.

The project described in this paper is successful because of the vision and persistence of two FVTI--Oshkosh staff members: Sylvia Gasser, a Learning Lab instructor, and Marty Bruflat, Special Education Coordinator. They knew what they wanted. Because they were willing to walk uncharted trails, they got it.

Apple is a registered trademark of Apple Computer Inc.; Echo II is a registered trademark of Street Electronics Inc.; Power Pad is a registered trademark of Chalk Board, Inc.

Control Without Keyboards, The Speaker II, The Speaker III, and Two-By-Two are copyright software programs of J Jordan Associates.

ABLEDATA: A COMPUTERIZED PRODUCT GUIDE

MARIAN HALL

ABSTRACT

ABLEDATA is a specialized resource that indexes commercially available products useful to disabled persons. The data base presently documents over 11,000 products ranging from personal care devices to computers. The information is continually expanded and updated as new data is identified. ABLEDATA is available to anyone through BRS (a database vendor), by either the standard BRS subscription (or BRS After Dark) or by using the services of a resource center with access to BRS (e.g., NARIC, Independent Living Centers, special libraries). Using ABLEDATA alleviates the time investment needed to develop and independently maintain complete product files. It also assists in locating obscure products from small manufacturers without the resources to do mass-marketing.

Today, everyone is aware of the information explosion; it is particularly apparent with rehabilitation technology. More and more devices are being produced to assist people in all kinds of activities, but learning what equipment exists and how to locate it is a major problem for most people. As the information base expands, mechanisms must be organized to make the information available to those that need it.

One mechanism available today is an automated index or database. A database is only a computer equivalent of a printed index but with the advantages of quick updating and the fast information retrieval.

Hundreds of databases are available to searchers through database vendors. ABLEDATA is one of these databases. ABLEDATA is produced by NARIC, funded by the National Institute of Handicapped Research, of the U.S. Department of Education. It indexes commercially available rehabilitation devices and other products useful to persons with disabilities.

ABLEDATA began in 1977 as a project to index manufacturers' catalogs of rehabilitation products. The initial system was a manual index, but even at that time the information was expanding so rapidly that the need to computerize the information became necessary immediately. It was apparent that if the database was developed as a central information system available to all, it would result in a cost-effective service for programs that needed this information.

By the end of October, 1984, there will be 11,000 products listed on ABLEDATA making it the most comprehensive single listing of rehabilitation product information. In the coming year a minimum of 1,500 new products will be entered and a major emphasis will be on further developing the process of updating the data.

Accessing ABLEDATA and Cost-Effectiveness

ABLEDATA, as any database, is designed to be used as a resource tool, by providing assistance with decision making and effective service delivery. It can be used directly by persons owning computer terminals (a computer is not necessary) by obtaining a subscription to BRS, the database vendor who maintains ABLEDATA.

Costs of online searching include the BRS subscription, telecommunication costs (e.g., Telenet), and database royalty. For ABLEDATA, daytime searching costs range between $39 and $58 per hour, and evening searching on BRS After Dark costs $12 per hour. At first, the cost of searching ABLEDATA may seem unrealistic to resource programs needing information. The usual response is that they already have a person paid to manually track the information (collecting, organizing and retrieval as needed) and the organization does not feel justified in authorizing the cost of accessing the database. At NARIC the average direct cost of a computer search (including computer and mailing charges, but excluding staff time) is $10.00. For that $10.00 the computer searches the equivalent of 14 file drawers of product literature, and total staff time involved per request averages less than 15 minutes. The alternative of manually searching for the desired products, if all the file literature is available, takes hours for each request. By using a database to assist the information provider, even a small organization can use the staff's time to either perform other tasks or answer more information requests. As one therapist observed during a demonstration search costing less than $3.00 of online time, the hospital she worked for would have to charge that much for her time to open just one file drawer and start the searching process.

For individuals, as well as organizations without access to BRS, the information on ABLEDATA is available through intermediary sources. Many organizations, including NARIC, answer information requests for anyone. Also, most large libraries have BRS subscriptions and if the person knows the terminology to help define the search most librarians can perform the search at a local library. Many resource programs provide searches free of cost and others charge minimal fees to help defray costs.

Database Content

The products listed in ABLEDATA are categorized by functions, such as personal care, mobility, or communication. The products are not classified by disability (with the exceptions of Sensory Disabilities, and Nonvocal and Speech Impaired). The reason products are not classified by disability is that most products are used by people with a wide range of disabilities. The same product may or may not be used by two people with the same disability depending on the level of dysfunction. But ABLEDATA is relatively simple to access as the products are defined by function.

ABLEDATA has fourteen major categories of equipment:

- Personal Care
- Home Management
- Vocational-Educational
- Mobility
- Seating
- Transportation
- Communication
- Recreation
- Ambulation
- Sensory Disabilities
- Orthotics
- Prosthetics
- Therapeutics Aids
- Architectural Elements

These categories, with further sub-categories, form the basic structure of the ABLEDATA Thesaurus. The Thesaurus also has all generic names listed, and for every generic name there is one, or more, product(s) in the database. The Thesaurus and other searching aids are available from NARIC to assist with searching the database.

Each product document has the following paragraphs:

AN	Accession Number
NM	Generic Name
BN	Brand Name
MN	Manufacturer
CD	Code Number
AV	Availability
CT	Cost
DE	Description
ID	Identifiers
CM	Comments
EV	Evaluation

The Accession Number, Generic Name, Code Number, Availability, Description and Identifiers are required paragraphs in every product document. The Brand Name, Cost, Comments and Evaluation paragraphs are completed when information is available.

The Comments paragraph is used for subjective information about a product (e.g., safety related information, use information, accessory compatibility information). Anyone may submit information to enter into this paragraph, but all data is reviewed for appropriateness and is edited prior to entry. The Evaluation paragraph is reserved for formally documented product evaluations, and unfortunately there are very few available to add to the database.

SAMPLE ABLEDATA DOCUMENT

AN	84-01-001318
NM	MULTILINGUAL AND SYMBOLIC LANGUAGE SYSTEM.
BN	TALKING PICTURES.
MN	CRESTWOOD CO., 331 SOUTH THIRD St., P.O. BOX 04513, MILWAUKEE, WI 53204.
CD	618.
AV	MANUFACTURER
CT	$18.75, 0783.
DE	Kit consisting of four components, a file box containing 110 cards showing the necessities of every day life, 10 heavy duty vinyl envelopes, and one metal ring. Each card has a picture with a corresponding word. Reverse side has the word equivalent in English, Spanish, German, French and Italian. There are eight classifications of cards separated in the file box by colored dividers: room, bathroom, health, aids, food, clothing, people, and miscellaneous. To use, the cards are placed in vinyl envelopes which are placed on metal rings. Metal rings and pictures can be attached to bed, wheelchair, etc. User points to appropriate card to indicate needs.
ID	COMMUNICATION. NONVOCAL AND SPEECH IMPAIRED. COMMUNICATORS. LANGUAGE SYSTEMS.
CM	Useful as an augmentative communication aid for nonverbal individuals. Also useful as a language teaching aid for preschool children, mentally handicapped children and individuals learning English as a second language. Cards can be handmade and covered with clear contact paper but handmade price is comparable to price listed.
EV	Not available.

Searching ABLEDATA

ABLEDATA, like all BRS databases, can be searched two ways. The Generic Names and Identifiers from the Thesaurus can be used as controlled vocabulary and searched specifically as written. This will result in extremely wide-based searches if an Identifier term is used, or in an extremely narrow search if a specific Generic Name is used.

ABLEDATA can also be searched by free-text searching, which means any English word or word stem can be searched on the database. By combining appropriate words with careful search strategy techniques, specific features of equipment can be searched. BRS does provide training to learn the basics of searching on BRS databases, and NARIC provides workshops on learning to search ABLEDATA.

Summary

There are many advantages to using online information databases. Using a database is much more efficient and cost-effective than manual searching for specific information, whether it is products or literature. And, while using a database such as ABLEDATA requires learning simple searching techniques, it is not necessary for a searcher to know computer programming or understand the mechanics of database storage and retrieval.

ABLEDATA, through BRS and BRS After Dark, is a resource tool for any information program to use. ABLEDATA is also a place for users of equipment to share subjective information about specific equipment. It can readily be updated or changed as needed.

ABLEDATA has developed into a well used central information system to help information providers quickly locate information on products. It should be noted, however, that it is not by any means "complete" in the sense that it has every single product that is available on the market. The goal is to make it as complete as possible, but this will take time.

While learning is necessary for every new user of online information systems, most users will find the costs are more than compensated by the major reduction in time when compared to manual searching.

For further information about BRS or BRS After Dark subscriptions please contact:

BRS
1200 Route 7
Latham, NY 12110
(800) 833-4707
(800) 553-5566 NY

For more information about ABLEDATA or NARIC please contact:

NARIC
The Catholic University of America
4407 8th Street, NE
Washington, DC 20017
(202) 635-5822
(202) 635-5884 TDD

USING MULTIPLE DATABASES IN REHABILITATION OPERATIONS

DAVE SHAFER

ABSTRACT

Current, fully operational rehabilitation computer databases are identified and summarily profiled in this paper. Operational problems and their solutions, when enhanced by database use, are presented. Validity and reliability of database applications to solution strategies and tactics are described. Capital intensive cost feasible components of databases are identified. Utilitarian processes to access databases for operations purposes are outlined.

The harmony between computer users who are rehabilitation professionals and computers is now within reach of all rehabilitation professionals. Having assembled a talented team of top professionals, all technologically and computer literate, we have been able to manipulate multiple databases to the advantage and service of clients and staff in a large rehabilitation facility.

The opportunity to welcome technology as a way to access and manipulate information in "just in time" situations has enhanced the quality of services in evaluation, training, counseling, and placement.

The introduction of easy access to multiple data bases has given staff in all four departments a whole new set of tools for the job. Inspection of Tables 1-4 will show some of our experiences with these "tool" processes, all of which can be performed with blazing speed and accuracy by host computers located around the United States. Each database offers internal yet powerful nuances that aid in crystallizing a rehabilitation professional's thinking.

We also use ancillary computer-based assessment components that generate, interactively, fresh aptitude scores as well as other data for use in the rehabilitation process.

Each database and its components compress by 80% or more the time it takes to manually generate and format rehabilitation-related data. These databases offer efficient time management of clients cases.

These databases, used with national supporting databases like ABLEDATA which lists over 10,000 function enhancing devices, have shown remarkable progress in the rehabilitation process.

Information utilities like SOURCE and COMPUSERVE have rapidly expanding components that serve the rehabilitation community. For example, SOURCE has established a job network that lists 3,000 jobs in 40 occupational areas. That component is operated by 65 headhunters who never charge a fee.

How does a professional rehabilitation team decide which database meets their needs? As there are at least 60 competing databases, with more on the way, it is not an easy decision. In Table 5 some questions are presented that can be asked of a prospective database. We ask these types of questions about any database.

We access at least ten databases per client daily. All are cost feasible. We bully them to deliver information products that aid in rehabilitation process.

Rehabilitation professionals can acquire skill with these databases using a small investment in training time. For example, two days of tutorial training with the Center (or other agency) prepares staff to practice for twenty hours more; the end result is proficient use of the database. We train in the database known as Ability Information System, of Spokane, Washington. We also provide training with many other databases.

The benefits of expending two days of staff time, along with the practice time recommended, can, in the Center's opinion, stand the test of cost and program accounting.

In summary we have acquired the capability, via computer databases and related technology, to:

- Construct a composite profile of a client that contains multiple data elements useful restructurable throughout the rehabilitation process.
- Discover devices to enhance a disabled person's physical and intellectual functions.
- Generate and compare possible job titles on many points of a client's composite profile.
- Generate possible employers in a geographical area of interest to a client.
- Generate many types of data requested by any member of the rehabilitation professional direct service and support team.

Perhaps Douglas Benefield, recently killed in a test accident in the Air Force's B-1-A, points to the spirit of inquiry at our Center and NYU. He said, in the week's before his death, "We're always looking at another frontier...the edge of...technological endurance."

N.B. See Appendix A

Table 1

Using Databases to Enhance A Client's Evaluation

AIS - Using such program components as "Title" the vocational evaluator can explore truncated job titles. It is common to learn of a job not previously identified in book-based searches such as the DOT, e.g., Program Specialist-Employee Health, a high-paying job with companies like Mobil. This program is used in one phase of the evaluation program.

ABLEDATA and others - Not infrequently a client will mention a job title as his/her quest. Having obtained the physical requirements of the job from AIS, the evaluator can compare the job's requirements with the disabling condition of the client, as well as function enhancers in the over 8,000 products in ABLEDATA, Tech-Knowledge and other databases. At the same time CIS, JAN and other databases that list at-the-job modifications made by employers can offer hope to a disabled client for keeping a job title in their quest.

RehabDATA and others - Allows the evaluator to identify other agencies working on a specific problem that is being experienced by a client. Insights into the client's problem are gained by accessing this database, as well as ROME and others in the BRS collection of bases.

Table 2

Using Databases to Enhance a Client's Training Program

AIS - The variety of powerful, swiftly operating database components allow the training coordinator and faculty to enhance their perception of skills acquistion needs of the client before, during and after a training cycle.

ABLEDATA - As impediments to skill acquisition by a client occur, due to physical function limitation, this database allows staff to identify off-the-shelf devices to enhance a function.

RehabDATA (NRIC) - Allows staff to locate providers of a variety of services clients need during training. (Used with AIS)

SpecialNET - Used by staff to seek suggestions for a particular client-related problem from other practitioners.

IJB - Used by staff to identify "hot" job prospects at any of 2000 USES offices.

BRS - Staff uses a variety of its bases to obtain reliability/validity data on instruments being used. This is one of the many uses of BRS bases.

Table 3

Using Databases to Enhance a Clients's Placement

AIS - Allows identification of possible job titles in light of a disability. Allows identification of employers in a particular industry. Some actually have job openings on the day of the search. Allows multiple manipulations of data for control of many client variables in seeking best possible job titles.

ABLEDATA/JAN - Both bases allow identification of devices either carried to or already at a job site designed to enhance a physical function. Tech-Knowledge and other bases also are dedicated to the same end.

SpecialNET/CARI - Both bases offer employment possibilities. The former by showing openings, the letter by having a total client's resume and supporting materials in memory for access by subscribing companies.

IJB - While only online to USES offices with compatible equipment, it still, via fiche, provides data on jobs for which a qualified applicant was not found for ten business days. (All 2,000 USES offices, mailed to you on the following Monday of each week-free)

Table 4

Using Databases to Enhance Client Counseling

AID - Allows counselor to search based on client INTERESTS with or without a client profile.

Allows counselor to compare a client's abilities based on work history and adjusted profile, by those required for a specific job.

ABLEDATA - Allows counselor to identify early in the counseling process:

Assistive Devices
Components for Later Assembly into custom devices

NARIC - Allows counselor to identify helping agencies for specific need in a specific location when coupled with AIS.

CARI - Allows counselor to begin client training in resume formatting.

IJB - Allows counselor to demonstrate current availability of targeted jobs in any location in 50 states. Each job shown is available for a qualified applicant.

Compuserve - Allows counselor to connect client with many other disabled persons with similar interests nationally Online at cost feasible prices.

Table 5

Characteristics of a Good Occupational Information Delivery System

1. Make the information accessible to persons of varying ability, experience and interests.
2. Provide a Means for integrating the occupational information with clients' interests, values, aptitudes, and abilities.
3. Deliver the information through various media.
4. Display and/or deliver the information in an attractive manner.
5. Provide accurate and current information, including the capacity for updating.
6. Supply local as well as national data.
7. Provide information concerning a wide variety of occupational groups.
8. Include such specific information as (a) job duties, (b) work environment, (c) hiring and training requirements, (d) terms of employment, (e) hours, (f) current labor market situation, and (g) long-range outlook.
9. Be available at a reasonable cost which would be compatible with poverty-stricken school districts and social agencies.

Appendix A

One day through the primeval wood
a calf walked home as good calves should:
but made a trail all bent askew
a crooked trail as calves all do.

Since then three hundred years have fled,
and I infer the calf is dead,
but still he left behind his trail,
and thereby hangs my moral tale.

The trail was taken up next day
by a lone dog that passed that way:
and then a wise bellwether sheep
pursued the trail o'er vale and steep
and drew the flock behind him, too
as good bellwethers always do.

And from that day, o'er hill and glade,
through these old woods a path was made
and many men wound in and out,
and dodged and turned and bent about,
and uttered words of righteous wrath
because 'twas such a crooked path;
but still they followed...do not laugh,
the first migrations of that calf.

This forest path became a lane
that bent and turned and turned again
this crooked lane became a road,
where many a poor horse with his load
toiled on beneath the burning sun
and traveled some three miles in one,
and thus a century and a half
they trod the footsteps of that calf.

The years passed on in swiftness fleet;
the road became a village street;
and this, before men were aware,
a city's crowded thoroughfar,
and soon the central street was this
of a renowned metropolis.

And men two centuries and half
trod in the footsteps of that calf.
A hundred thousand men were led
by one calf near three centuries dead,
for men are prone to go it blind
along the calf-paths of the mind
and work away from sun to sun
to do what other men have done
they follow in the beaten track,
and out and in, and forth and back,

and still their devious course pursue
 to keep the path a sacred groove
along which all their lives they move,
 but how the wise old wood gods laugh
who saw the first primeval calf!
Author Unknown

ADVANCING THE TRANSDISCIPLINARY FIELD OF AUGMENTATIVE AND ALTERNATIVE COMMUNICATION TECHNIQUES AND AIDS

PATRICIA L. CASHDOLLAR

ABSTRACT

The International Society for Augmentative and Alternative Communication (I.S.A.A.C.) exists to advance the transdisciplinary field of augmentative and alternative communication techniques and aids. I.S.A.A.C.'s mission is to facilitate the exchange of information and focus attention upon work to help people with communication difficulties throughout the world. Information and referral services are available for users, potential users, professionals, family and community members who wish to support those using augmentative and alternative communication systems and devices. Publications such as the official newsletter, Communication Outlook, and The Augmentative and Alternative Communication Journal are available. Conferences and scientific meetings are planned. A computer conferencing network is available. Work in the international field of augmentative and alternative communication is complex and time consuming. Information is being shared and channeled throughout the international community for the benefit of the professionals in the field and the augmentative and alternative communication system user.

Introduction

The international Society for Augmentative and Alternative Communication (I.S.A.A.C.) was formed in East Lansing Michigan in May of 1983 following the expressed wishes of participants at the 2nd International Conference on Augmentative Communication in Toronto, Ontario in November of 1982.

The Ontario Institute for Studies in education (OISE), The Augmentative Communication Service (ACS) of the Ontario Crippled Children's Centre (OCCC) and the Blissymbolics Communication Institute (BCI) sponsored the 2nd International Conference in 1982, responding to the needs articulated in the 1st International Conference in November of 1980.

Penny Parnes, Director of the ACS and Vice-President in charge of Conventions and Scientific Meetings for I.S.A.A.C. reported in the September issue of Communicating Together, "The first conference ...attempted to deal with diverse issues such as technology, systems, assessment and applications."

"Behind the scenes at the second conference (1982), there was another agenda taking place...how were we going to keep this action alive; how were we going to promote the growth of our field; how could we keep the spirit of cooperation and the enthusiasm we were feeling?"

When a small group came together in May of 1983 through the hospitality of Dr. John Eulenberg, Director of the Artificial Language Laboratory at Michigan State University, each of them could look at their work with persons who needed a system other than spoken word to communicate and say that indeed they didn't have time for one more organization or obligation. Work in the international transdisciplinary field of augmentative and alternative communication is very complex and very time consuming. It is a relatively new field and those who met were known to one another from various professional affiliations and published works.

As they were belaboring the point of the work load each was carrying, they came to the conclusion that they couldn't afford not to get organized and share information with one another. The research effort in the field of high technology demanded those involved keep abreast of the most recent developments. The thirty-five representatives from seven countries decided to work together to advance this relatively new transdiciplinary field of augmentative communication techniques and aids. Organizational work began. The International Society for Augmentative and Alternative Communication (I.S.A.A.C.) was born and planning for the Third International Nonspeech Conference was started. The Third International Conference on Augmentative and Alternative Communication occurring October eighteenth to October twentieth, 1984, at M.I.T., will include over one hundred authors and presentors. Copies of the I.S.A.A.C. Conference Program are available from the Special Events Office, MIT, Building 7-111, Cambridge, Massachusetts 02139.

Communication/I.S.A.A.C.

Communication is the key. I.S.A.A.C.'s membership is international and includes all those interested in augmentative communication. Users and Potential Users of communication systems and devices, Speech Pathologists/Language Development Specialists, Educators, Occupational and Physical Therapists, Rehabilitation Specialists, Social Workers, Linguists, Engineers, Computer Scientists, Psychologists, Medical Practitioners, Family Members, and Community Members wishing to support the communication of those using augmentative and alternative systems and devices are invited to join the organization. I.S.A.A.C. brochures and membership forms are available in the United States from:

Susan Sansone
I.S.A.A.C. Membership Co-Chairperson
New York State Association
for Retarded Children, Inc.
2900 Veterans Memorial Highway
Bohemia, NY 11716

In Canada, contact:

Elaine Heaton
I.S.A.A.C. Membership Co-Chairperson
Glenrose Hospital
10230 - 111th Avenue
Edmonton, Alberta, Canada T5G 0B7

Communication/CONFER

How do all of us communicate with one another and with communication system users?

The computer conferencing network of ISAAC is Confer II, a multi-purpose communications medium, developed by Robert Parnes at the University of Michigan and offered by Advertel Communication Systems. The ISAAC Confer "conference" is IPC:AC International Project on Communication: Augmentative Communication) and is administered by the Blissymbolics Communication Institute, Toronto, Ontario, Canada.

Confer users connect computer terminals by telephone with a central computer to exchange messages or participate in public discussions. Confer makes group discussions possible as well as electronically sending and receiving documents or data.

Some of the benefits of Confer are:

- Freedom to use where and when convenient
- Many topics can be discussed simultaneously
- A written record is produced
- Concise interchanges take place
- Friendly atmosphere conducive to successful communication

To use Confer you must have access to a computer terminal or a personal computer with communication capabilities, a modem, and a phone. Confer users pay only for the actual computer time they use. The total cost for Confer, including computer time and network charges is approximately thirty cents per minute or an average of less than five dollars a day for very heavy users. Confer registration forms are available from the Blissymbolics Communication Institute, 350 Rumsey Road, Toronto, Ontario, Canada, M4G 1R8.

People in most major cities of the U.S., as well as thirty-two other countries world wide, Confer inexpensively through the public data communications networks.

If you would like further information about Confer, or you would like to arrange for a demonstration, please contact:

Advertel Communication
Systems, Inc.
2067 Ascot
Ann Arbor, MI 48103

Communications/International

According to Dr. John Eulenberg of the Artificial Language Laboratory at Michigan State University, "ISAAC can be truly effective as an international organization only if it can link people of similar interests and similar purposes throughout the world. ...Through its publications, conferences, and other activities, ISAAC lets people in other countries know about this field and consider the actions they might take to establish it at home."

Dr. Eulenberg makes specific recommendations for fellow members of ISAAC to share expertise on augmentative and alternative communication (A&A). This would be accomplished through programs of

a. visiting professionals;
b. scholarships and fellowships;
c. grants of equipment accompanied by appropriate training;
d. development grants in rehabilitation and special education; and
e. support for conferences and sessions within conferences.

The attention of persons working in the field of A&A technology is directed to the existence of an organization and publication concerned with appropriate and accessible technology, including communication aids, for people in developing countries:

AHRTAG (Appropriate Health
Resources and Technology
Action Group)
Editor: Ann Darnbrough
Address: 85 Marylebone High St.
London W1M 3DE,
United Kingdom

I.S.A.A.C. has a Committee for Developing Countries chaired by Anne Warrick of the Blissymbolics Communication Institute. She states, "The contribution which members from developing countries can make to ISAAC is recognized and will be one of the organizations strengths."

Communications/Publications

Publications are another means of communication. The official newsletter of ISAAC is Communication Outlook published by the Artificial

Language Laboratory. Communication Outlook is a quarterly, technical/professional newsletter provided as part of membership dues. Communication Outlook is available outside of membership in ISAAC for a subscription rate of $15.00. Communication Outlook solicits a wide range of items for publication. These include articles by users or potential users of communication aids, as well as their parents, teachers, speech parthologists, rehabilitation engineers, etc.

Future activities of Communication Outlook include publishing the first update to the Communication Enhancement Bibliography and adding a consumer forum feature to the Newsletter from consumer members of ISAAC. For more information, contact:

Kristine Portnoy
Associate Editor
Communication Outlook
Artificial Language Laboratory
Michigan State University
East Lansing, MI 48824

Coming January 1985! Augmentative and Alternative Communication: The Official Journal of the International Society for Augmentative and Alternative Communication. Williams & Wilkins will publish Augmentative and Alternative Communication as a refereed, quarterly, professional/scholarly journal. AAC is the official international transdisciplinary journal of I.S.A.A.C. David E. Yoder, Ph.D., is the Editor. Dr. Yoder is particularly interested in reviewing well written and documented case studies and single subject research. Submit four copies of manuscript typed double-spaced using APA style to:

David E. Yoder, Editor, AAC
Waisman Center
University of Wisconsin
1500 Highland Avenue
Madison, WI 53706

Published Proceedings of the Third International Conference on Augmentative and Alternative Communication will be available for purchase.

Communications/Organizations

The Rehabilitation Engineering Society of North America (RESNA) has publications of interest available as does the International Committee on Rehabilitation Engineering (ICRE). Both organizations have regularly scheduled conferences.

The International Project on Communication Aids for the Speech Impaired (IPCAS), was started in 1979 in order to promote activities and information sharing within the field of augmentative communication. IPCAS presently has four member countries: Canada, Sweden, United Kingdom, and the United States.

The member countries of IPCAS have decided to award an annual fellowship for the conduction of a study within the field of special relevance to communication enhancement technology. The topic for the 1984 study is "Synthetic Speech as an Aid for People with Speech-Language, and Communication Problems." The 1984 fellowship has been awarded to Professor Gunnar Fant, Department of Speech Communication and Music Acoustics, Royal Institute of Technology, Stockholm, Sweden. The study will be conducted in cooperation with the Swedish Institute for the Handicapped. The report of the IPCAS study is expected to be available early in 1985. For more information, contact, Professor Gunnar Fant at the Royal Institute of Technology, S-100 44 Stockholm, Sweden.

The results of Arlene Kraat's study of interactive strategies as a fellow of IPCAS will be available at the I.S.A.A.C. Conference at M.I.T., October 18-20, 1984.

The American Speech-Language-Hearing Association (ASHA) has publications of interest available and regularly scheduled conferences with sessions specifically addressing augmentative communication. For information contact ASHA at 10801 Rockville Pike, Rockville, MD 20852.

The Consumer Affiliate of the American Speech-Language-Hearing Association is NAHSA, the National Association for Hearing and Speech Action. NAHSA is also located at 10801 Rockville Pike, Rockville, Maryland 20852. You can call the NAHSA Hearing and Speech Helpline collect at 0-301-897-8682 Voice or TTY to answer consumer questions concerning speech, language and hearing problems.

The TRACE Center at the University of Wisconsin/Madison periodically publishes a list of reprints available from their reprint service specifically addressing the topic of Augmentative and Alternative communication. One particular document of interest from the TRACE Center is Highlights of the Current International Communication Aids Compatibility Standards Proposals (ICAC Stds.) The document contains the highlights of five separate and independent compatibility proposals for communication aid systems. Included are highlights of the SET, SETSC, KEI, KEIMC and ISA Compatibility Std. proposals as of June 7, 1984 by Barry L. Rodgers. For information contact:

TRACE Center
314 Waisman Center
University of Wisconsin
1500 Highland Avenue
Madison, WI 53706

Truly we need to polish our methods of communication with one another. Another need is that of learning to communicate more effectively with the augmentative and alternative communication system user. Arlene Kraat's report ought to shed some interesting lights on that subject. Please see previous references.

Workshops and Conferences such as Discovery '84 are invaluable for getting the word out about technology available today. We need to proceed with the valuable research and technology that will open the doors to the world for many disabled persons. The most recent brochure illustrating services being provided by Good Samaritan Hospital in Portland, OR states, Talk to Me: and Speak Your Mind. That is an admirable goal for us all.

Facilitating the communication among professionals is what ISAAC is all about. Facilitating the communication between users of augmentative and alternative communication systems and the world in which they live is what ISAAC is all about. Providing information and referral services to consumers and the professionals who work with them and with their families is what ISAAC is all about. Won't you join us?

BIOMEDICAL TECHNIQUES FOR POST HEAD TRAUMA VICTIMS

JUDITH V. DONEY

ABSTRACT

Most people who sustain head injuries are under the age of 30 and are injured as the result of tragic motor vehicle or sports accidents. The number of deaths each year resulting from head trauma is estimated at over 100,000. Of those who survive, 50,000 people annually are afflicted with intellectural impairment to the degree that they never return to a normal life. These figures which clearly reflect a problem of epidemic proportions, are the basis for the term, "The Silent Epidemic." Until recently this "lost population" was silently and shamefully closeted away and inappropriately placed in psychiatric institutions, schools for the retarded, or nursing homes. Now, rehabilitation centers with interactive programs of cognitive retraining, neuropsychology, as well as traditional therapies and medical care, are springing into operation; with them biomedical techniques are being developed to aid victims' and families' in their return to a more normal way of life.

Post head trauma victims have received a wound and/or injury due to a direct or indirect blow to the head. As head traumas produce many different deficits, only a few that are the most common will be discussed.

Effects of Head Trauma on Victims

Impaired cognition (a decrease in mental awareness) is evidenced by concrete limitations (the inability to comprehend abstract concepts such as love), long and/or short term memory losses, including memory lapses, a short attention span, the inability to make good value judgments (such as deciding that watching television is more important than eating a balanced meal), and problem solving difficulties, especially were special and sequential abilities are required (such as giving directions to someone, or deciding in which order to put on clothing). Preparing lists such as the one in Figure 1 and posting it in an appropriate location helps the victim to do these types of tasks more independently.

Figure 1

PERSONAL HYGIENE REMINDERS

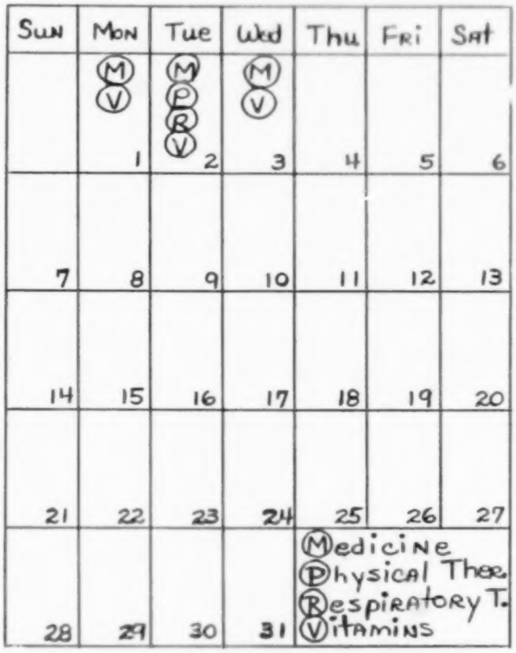
1. *Take Shower with Soap*
2. *Wash Hair with Shampoo*
3. *Comb Hair*
4. *Brush Teeth with Toothpaste*
5. *Use Mouthwash*
6. *Shave*
7. *Put on Deodorant & Talc*
8. *Put on Clean Clothes*

DRESSING SEQUENCE

1. *Undershirt with label in the back*
2. *Briefs with label in back*
3. *Socks*
4. *Shirt; button all buttons*
5. *Pants; zip them up*
6. *Belt; buckle it*
7. *Shoes; tie them*
8. *Sweater or Jacket with label in back*

Alarm clocks, timers, watches with alarms, and calendars are good tools for assisting the memory of tasks such as taking medications, doing physical therapy, or keeping doctors appointments. Diaries also help the victim remember the events of the past when annotated with at least one sentence a day.

Figure 2



Sun	Mon	Tue	Wed	Thu	Fri	Sat
	Ⓜ Ⓥ 1	Ⓜ Ⓟ Ⓡ Ⓥ 2	Ⓜ Ⓥ 3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	Ⓜedicine Ⓟhysical Ther. Ⓡespiratory T. Ⓥitamins		

Many trauma victims experience profound effects on oral and written communication. Victims have difficulty finding appropriate words and verbally communicating them. Sometimes this aphasia is compounded by stuttering; this problem may sometimes be lessened if they tap a finger slowly on their knee and speak at the same rate as the tapping. Written communication can be effected by a physical disability and/or the injured brain's inability to relay the appropriate messages to the hand.

All of the senses can be effected. Hearing acuity might be within normal limits, but the brain's ability to identify, select, separate, and accurately interpret what it hears may be impaired. Smelling, tasting, and tactile senses usually decrease significantly, and sometimes cease to function. Visual acuity and perceptions of color, depth, distance and periphery (tunnel vision) usually decrease; along with visual acuity loss is a decreased ability of the brain to accurately interpret what it sees. One way to aid a color-blind victim in the selection of clothing, is to place shirt, tie, slacks and socks that match all on one coat hanger.

When more sensory input is received by the injured brain than it is able to process at one time, it becomes confused and may stop processing anything but autonomic functions (such as breathing and heartbeat). This sensory overload leaves the victim quite frustrated. For these occurences, relaxation therapy may be of great help.

Figure 3

DAILY SCHEDULE OF ACTIVITIES

	Monday	Tuesday	Wednesday	Thursday	Friday
6:00 AM	Personal Worship & Prayer	Personal Worship & Prayer	Personal Worship & Prayer	Personal Worship & Prayer	Personal Worship & Prayer
7:00 AM	Personal Devot'ns Meditate.	Personal Devot'ns Meditate.	Personal Devot'ns Meditate.	Personal Devot'ns Meditate.	Personal Devot'ns Meditat.
8:00 AM	Breakfast & Dress	Breakfast & Dress	Breakfast & Dress	Breakfast & Dress	Break. & Dress
11:30 AM	Walk	Walk	Walk	Walk	Walk
12:30 PM	Lunch	Lunch	Lunch	Lunch	Lunch
1:30 PM	Nap	Nap	Nap	Nap	Nap
6:30 PM	Supper	Supper	Supper	Supper	Supper
11:00 PM	Lights Out	Lights Out	Lights Out	Lights Out	Lights Out

A daily schedule, such as

the one in Figure 3, will help the victim with a lack of motivation and poor time management. Small, pocket sized notebooks, with pages such as Figures 4, 5, and 6, are helpful in remembering personal vital statistics for emergencies, keeping track of prescriptions, and appointments.

Figure 4

IDENTIFICATION & VITALS

NAME: M Ed Doney AGE: 26 MS: M RACE: C
ADDRESS: 2715 Delta Dr PHONE: (601)366-8827
CITY: Jackson STATE: MS ZIP: 39213
MEDIC ALERT HISTORY NO: 14,420,997
MEDICAID NO: 600-32-7992
UMC PATIENT HISTORY NO: 505103

DIAGNOSES: Organic Brain Syndrome (7/9/81)
Petit Mal Seizures
Tunnel Vision (10^0-15^0 Field)
Hearing Discrimination (only 60%)
Speech Impairments
Poor Equilibrium
Duodenal Stress Ulcer
Wearing Contact Lenses
ALLERGIC TO: Dilantin
histalet derivatives

WARNING: Startles easily; Prone to violence

Figure 5

PRESCRIPTIONS

Drug	Rx No	Date of Last Refill	No of Refills
Benadryl	6006356	Sept 6 '84	0
Lopressor	6008066	Jul 16 '84	0
Phenobarb	C-11375	Jun 16 '83	1
Tagamet	6010054	Sept 6 '84	0
Valium	4010055	Sept 6 '84	0
Zorprin	6009233	Aug 14 '84	0

Harlan's Discount Drugs (601)362-8824
2918 Delta Drive Jackson, MS

Figure 6

APPOINTMENTS

Date	Day	Time	Place
Oct 5	Fri	2:00 PM	Rick Fortune ILC
Oct 6	Sat	1:00 PM 7:30 PM	Bethel - Music Bethel - Church
Oct 7	Sun	10:30 AM 7:30 PM	Bethel - Church Bethel - Prayer
		CLEAN CONTACTS	
Oct 8	Mon	11:00 AM 2:00 PM 7:30 PM	Music Lesson Rick Fortune ILC Spanish Class
Oct 9	Tue	1:00 PM 2:00 PM 7:30 PM	Dr Webster UMC Rick Fortune ILC Bethel - Church
Oct 10	Wed	2:00 PM	Rick Fortune ILC

Marked personality changes may also result from head trauma. Depression, inability to tolerate stress, childlike impulsiveness, naivety, impressionableness, investigativeness, emotional lability (quick, sudden and wide mood swings for no apparent reason), inappropriate behavior, preoccupation with self and an increased need for rest and/or sleep are to be expected. Victims also sustain high levels of frustration due to their inability to control their emotions (and sometimes physical violence), to fulfill their normal functions in the family's structure, to maintain good motor control of their bodies, and society's intolerance and rejection of them in their present state.

What You Can Do to Help the Victims

Professionals, family, friends, and society as a whole can help these head trauma victims by showing their acceptance; after all, the person trapped inside of the malfunctioning mind and body has not changed. Practice patience with them; be understanding and show the same kind of compassion that you would like to receive if you were in their place. Don't be overprotective and withhold information from them; that only keeps them dependent on others and is doing them an injustice. Give detailed information in simple language. Explain all known choices and allow them to make their own choices. New tasks will be more difficult for the victim to learn so expect repetition. If new surroundings and/or people are to be encountered, role playing ahead of time will make this easier. Don't be afraid to touch the victim; they need to be stroked just as we do. Discipline is a must, but do so with love.

Effects on the Victim's Family

If the victim is a spouse, the family role obviously changes from one of spouse/spouse to parent/-child, with the parent role being played by the uninjured spouse. Most of the responsibility for the retraining and its reinforcement falls on this spouse. This reinforcement requires incessant repetition which tends to make the uninjured spouse feel like a human tape recorder.

The head injured victim may be adult in body, but not in mind. The spouse has to think ahead, reason, anticipate all contingencies and make decisions for two. The victim cannot be pampered or pitied or he will become a domineering spoiled tyrant.

Spontaneity cannot exist within the relationship because the victim cannot cope with unknowns or the unexpected. Words have to be chosen carefully, the tone of voice delivered must be considered, and the facial expressions monitored. This self-censorship on the part of the normal spouse is necessary to avoid inappropriate behavior and, perhaps, embarrassing, violent physical outbursts in public. Schedules for the normal spouse are seemingly made to be broken, and they invariably are broken.

Socially, the healthy spouse is not married, but is not a widow(er); they are just in limbo. They don't feel comfortable going most places with the victim and can't leave them unattended, so it is easier to stay at home. Most acquaintances and friends won't tolerate the victim's idiosyncracies. Because of the unusual measures necessary to keep the victim under control, most people believe the spouse is cruel, domineering and overprotective. On duty 24 hours a day, 7 days a week, and using 100% of their attention, energy and time, the spouse finds it very difficult to enjoy normal sexual relations with the victim, even if the victim is able to perform.

What You Can Do to Help the Family

Professionals, other family members, friends, and society as a whole need to learn how to listen to the spouse when relating to the victim's peculiarities; after all, the spouse lives with the victim on a full time basis. People also need to realize that the uninjured spouse has just as many, if not more, needs than the victim. Learn to observe indications that the spouse needs help in coping, especially emotionally, with adjusting to a lifelong variety of disabilities. This is extremely difficult.

Above all, don't put down, disregard, or ridicule the faith of the victim and his(her) family; it can make the difference between life and death, literally and/or emotionally. For further information contact:

New Beginnings Ministries, Inc.
P.O. Box 31408
Jackson, MS 39206

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SPECIAL STUDENTS, TECHNOLOGY, AND BASIC SKILLS EDUCATION

LOUIS W. FRILLMANN

ABSTRACT

A study of the use of technology in assisting students with special needs to learn basic skills. Issues of concern to teachers, decision-makers and technocrats are addressed including:

1. What are the basic skills needs of special students?
2. How are these needs different than those of students in general?
3. Are these needs changing?
4. How do people learn basic skills?
5. Which instructional technologies can be used to teach basic skills?
6. What technologies are available?
7. What are their capabilities....their limitations?
8. How can we determine their effectiveness, their cost, and the demands they place on decision-makers?

The writer recognizes that a great deal more must be investigated about learning theory, about assessing learning styles, about determining educational objectives and about the handicapping conditions.

The "Not Quite" Child

You've seen him before as he often identifies himself. He lies concealed in the thicket of educational programming, like a newborn fawn . . . . while we wait for him to "grow out of it." Like a broken clock, he chimes only on the half hour, missing the number 12 completely. Playing him as a record, the young years, and on the wrong speed, he hears the discordant quality of his own learning, and the clear, groovy laughter of others. Stare as he may, or gazing pensively, (what is so crystal clear to children younger and smaller), words and their accompanying meaning clump together as an inky cage.

Even his walk appears to be that of a drunken sailor endeavoring to navigate a flagstone path, and finally noticing that every other stone is absent.

He becomes the recipient of drug therapy, the advocate of motor programs, the focus of commercially prepared materials, the proof of educational therapy, and a living, daily reflection of the fact that activity does not mean the same as achievement. The not-quite child suffers from hardening of categories. He may be condemned for his dissimilarities . . . . while his real need is that of understanding, rather than being made to walk/run/march/live to the same cadence as others.

He rides the high tide of frustration, crashing into the sea of classroom discipline like a giant breaker, only to become, moments later, the gentle spray of conformity. His path teeters between the soil of productivity and gravitation of academic quick sand.

He is the product of advancement in the space age as well as the neglected artifact of our educational ignorance in the area of human deviation. He is the guilt of professional lip service to the reality of individual differences. He is a rambler over bleak cliffs of parental despair, and the Grand Canyon of potential versus performance. He becomes a man without a country, with physician, educator, and family all drawing maps - often leading him away from things he knows toward even greater complexities. He ricochets among an avalanche of relevant literature, latest funding, and professional concern. He becomes the darling of pressure groups and the adopted child of parent associations. He is the straw that breaks the camel's back, the reason for teacher unions, and the Teen-age drop-out.

You've not seen valleys or mountain peaks until you scan his testing scores. He is the length and breadth of a teacher's TGIF. He defies description, as he is too young, too old, and too tormented. He fragments evaluations, defies diagnosis and confounds all who would lead him. He is on the right side of every educational cliche- "study more", "work harder", and on the wrong side of real meaning.

The child conceived, born and developed out of ambiguity has rendered a new impetus. He is forcing us, because of his "not-quiteness" to review the color, shape, size and intensity of our daily COMMITMENT. If he is to live among us, we cannot allow him to approach adulthood bewildered and lost. If we are to live with ourselves, we shall desire to take him to the park and spend many a sunny afternoon romping, listening, and when necessary, letting him show us his secret places.

Special Students, Technology, and Basic Skills Education

It has long been the dream of parents of special students and educators to match those students with appropriate educational technologies. Recent issues and demands place even greater burdens upon decision-makers as they balance budgets, initiate training programs, deal with technology specialists, and endeavor to produce the classroom environment called for by the I.E.P.!

Technology must be placed into the context of learning theories, styles, and the determination of educational objectives. There is no formula that tells us what technology to use with a specific learner for a given purpose; and if we did have a formula, would we be able to apply it? There are other factors that enter into the decision-making process, each factor is important. Factors include the nonavailability of equipment, the non-readiness of staff or structure, the prioritization of one medium and not another, the presence of technological tools without the educational objectives and many others.

Imperfect as our knowledge about the learning process and the impact of technology, let us acknowledge what we do know:

1. We know that technology is a support system that can be used for teaching and learning, to give us information about "how" and "when" and "where" a student learns best.
2. We know that technology may denote the use of a systematic process of designing and delivering instruction.
3. We know that, under the right circumstances,

technology can do some things as well as good teachers, and some things better.

4. We know that no single strand of technology is more effective than others for all purposes.
5. We know that technology is most effective when educators are most familiar with its capabilities and its limitations.

It is vital that we discuss and demonstrate the impact of technology on learning, student achievement, productivity, school faculty and staff, parents, management, and budgets.

Issues of concern to educators, decision makers and technologists include:

What are the basic skills needs of special students?
How are these needs different than those of students in general?
Are these needs changing?
How do people learn basic skills?
What instructional techniques can be used to teach basic skills?
What technologies are available?
What are their capabilities? their limitations?
How can we determine their effectiveness, their cost, and the demands they place on decision-makers?

The writer recognizes that learning theory must be investigated a great deal more in addition to assessing learning styles, determining educational objectives, and investigating the demands placed upon all of the foregoing by so-called "handicapping conditions," before we can expect to match special kids with appropriate educational technologies.

The Challenge for Administrators in Today's Schools

Articles published since the passage of the Basic Skills Act (Basic Skills and Educational Proficiency Program - Title II of the Educational Amendments of 1978) reiterate the themes that American education is not able to teach cognitive skills or to deliver a well-motivated and hard-working labor force. Where does this leave the education of students with special needs? While we can claim recent breakthroughs in employability and the passing of diploma exams, we must also face the dilemma of structuring and implementing each and every effort dedicated to the improvement of "learning the basic skills" - however they are defined.

Perhaps our task would be a bit less complex if there were any agreement between parents, educators, and the general public about just what "basic skills" are. Are they only the three R's? Must they also include behaviors, job responsibility, human sexuality? Have our expectations regarding basic skills changed with the introduction of communication and information technology? As one job in two is now related to information handling (1-SNYDER), that is, collecting, storing, transcribing, receiving, analyzing, packaging, or distributing information, shouldn't all students (ours included) be prepared to deal with it? Should basic skills now include critical reading, listening, loads of observational experiences, direct contact with decision-making processes or computer literacy? So, improvement is one thing, defining the problem is quite another.

Technology has and will cause changes. Perhaps the one change which strikes most boldly at the "past operational stance of far too many schools" is the change seen in individualization models for meeting the individual needs, interests, and capabilities of every student. P.L. 94-142 was aimed at just this element. Although not yet fully realized, recognition that students of the same age, in the same grade or class, do not have the same educational needs or learning patterns is changing the way that educators plan and deliver instruction. Side-by side with this change is the parallel development of strategies that actively involve students in the learning and decision-making process. Not an easy time for the "boss", especially when costs are up, enrollment, down, and the budget in a squeeze.

Learning Basic Skills

We are faced, once again, with many more questions than answers, with a critical question up front: WHAT ARE BASIC SKILLS?

Although basic skills are individually determined, most people consider reading, writing and arithmetic central to the curriculum of all schools. Independent living is still dependent upon skills in communication and computation. Few persons, however, would limit the total school offering to the R's and would variously insist on history, geography, citizenship education, science, art, music, and many others; we would quickly add mobility training, independent living skills, auditory training, physical and occupation therapy, behavior modification, job training and work experience, and others to the list.

The year and era of 1984 also raises valid curricular concerns for the '80s and beyond. Will grammar and spelling lose their focus and new importance be placed on the writing process and the structure of written products? (2-RUBIN) Will critical reading, listening and viewing skills become central as society recognizes the need for citizens to distinguish between truth and error, propaganda and fact? Is bilingualism already an outgrowth of communication and travel opportunities?

For those of us who believe that survival is as important as graduation, there is a whole new set of concern. They range from the prevention of institutionalism to "making it" in the work force. What is basic to others will surely not be basic to us. Our goals may be to focus on the blending of what we do best with what others can do to assist our students through vocational training, work opportunities, and habilitation/rehabilitation. Where do you start when you look at the needs of students who require a daily structured approach to learn to deal with themselves, their peers, school, and even basic skills? In such a context, keyboard literacy and early exposure to varied forms of technology will prepare them, hopefully, as consumers, employees, and citizens.

Surely technology can and does deliver instruction, but it is the ability to use the computer tool that is taking on new lustre:

- to solve problems.
- to communicate with others.
- to edit language and use of the functions of word-processing.
- to create graphs and pictorial devices that assist a person to learn and to convey information.

Which Instructional Techniques are Useful in Teaching Basic Skills

(It is difficult to imagine an instructional technique that would not be useful in teaching basic skills.)

..... Information Delivery

student-teacher interchange - directed instruction

lecture - media presentation - observation - direct experience

..... Demonstration

displays of physical/mathematical relationships

doing by an adult requiring a student to imitate

..... Drill and Practice

practice problems or exercises designed to reinforce learning gained from another source

the role of the computer and hand-held devices as scorekeeper, providing motivational feedback and tailoring type of practice depending upon student performance

..... Problem Solving

proposing a solution to a stated/generated problem, stating your own problem offering strategy and potential solutions, and then evaluating and rating

.... Tutorial

small, sequenced bits of a concept are presented

examples given to illustrate the concept

drills the learner - provides feedback on the learner's performance

summarizes the information learned-related it to what's ahead

PLATO - TICCIT - LAPS - even packs for teachers

..... Instructional Games

learning skills/concepts in a competitive cooperative environment

people learn when it's fun or challenging

allows for practicing the application of learned skills

How do People Learn?
or How Do People Learn Best?

No matter what is defined as a basic skill or who defines it, elements that lead to learning success in the basic skill may be common. Ironically, we still have much to learn about how people learn, yet we know from experience and research supports that people learn:

- When their current and changing needs, abilities and interests are accounted for.

pace and individualization

content and learning style

stimulating but not too difficult

flexible instruction and personal attention

- When they are actively involved in learning.

teacher directed instruction vs. student-led discovery

learning/retaining may well depend on learning/using

learning to talk by speaking vs. learning to talk by studying communication

- When they interact with others.

working along vs. learning with others present (3-CHAMBERS)

level of interaction necessary

to produce effective learning (4-JOHNSON)

- When a variety of techniques and materials are used.

variety enhances opportunity

caution raised re: overloading of sensory modalities

- When the design of the instructional materials is interesting and stimulating.

visual appearance - aural/tactile interest

color - animation - sound - graphics

- When they practice and review a skill or concept.

new concepts require reinforcement-old ones, review

- Simulation.

a representation of the key aspects of an environment-real or fictional

learner must make decisions, but does not experience them personally as in real life

generally do not teach basic skills - learner must apply learned skills

question: which comes first?

- Exploration (Inquiry).

student uses content/concept introduced by a teacher or media and then

experimentation, exploration, discussion, problem solving, research, application of what is known, unknown

Summary

Contributions of Technologies to Effective Learning

Meeting the current and changing interests, needs and abilities of individual students

Involving students actively in learning

Promoting interaction with others

Providing a variety of techniques and materials

The design of interesting and stimulating materials

Providing feedback to learners

Providing opportunities to practice a skill until it is mastered

Assessing the Impact of Technology on Education

- What Achievement Gains can Students make with Media?

test scores
learning time
degree of retention
course completion

- What New Skills and Knowledge will our Students learn with Media?

- What Impact will media have on Attendance, Attrition & Absenteeism?

adult education
continuing education
in-service training
on-the-job training
workshops for those who own personal computers (or are about to buy)
computer time during non-school

hours and weekends

- What Impact will media have on teachers and other school personnel?

  knowledge about the medium
  skills in using the medium - techniques
  skills in using media in the management of instruction
  skills in evaluating related materials
  skills in designing and developing materials

Individual Differences

Once upon a time animals decided they must do something heroic to meet the problems of a "new world." They adopted an activity (Basic Skills) curriculum consisting of running, climbing, and flying; to make it easier to administer, all the animals took all the subjects.

The duck was excellent in swimming, better in fact than his instructor, made passing grades in flying, but was very poor in running, so he had to stay after school and drop swimming to practice running. The schedule was maintained until his web feet were badly worn and he was only average in swimming. But average was acceptable in school, so nobody worried about that except the duck.

The rabbit started at the top of the class in running, but had a nervous breakdown because of so much "make-up" work in swimming.

The squirrel was excellent in climbing until he developed frustration in the flying class where his teacher made him start from the ground-up instead of flying down from the tree tops. He also developed "charlie horses" from over exertion and then got a "C" in climbing and a "D" in running.

The eagle was a problem child and was disciplined severely. In the climbing class he beat all the others to the top of the tree, but insisted on using his own, best way to get there.

At the end of the year, an abnormal eel that could swim exceedingly well, and also run, climb, and fly a little had the highest average and was class valedictorian.

The prairie dogs stayed out of school and fought the high school tax rates because the administration would not add digging and burrowing to the curriculum. They apprenticed their children to a badger and later joined the groundhogs and gophers to start a successful private school.

ANY LESSONS FOR US??????

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SENSORY AIDS DEMONSTRATION AND TRAINING CENTER

JERRY A. KUNS

ABSTRACT

The Computer Training and Evaluation Center, C-TEC is jointly sponsored by the Sensory Aids Foundation and the Veterans Administration-Western Blind Rehabilitation Center. The program offers information and training on computers for blind users. The objectives of this program are: To provide training on braille, synthesized voice, and large print equipment and custom software that gives blind individuals access to computers. To provide computer access awareness training for educators and rehabilitation personnel. To provide special access evaluations of hardware and software. And to provide public information.

We see in current societal trends an unprecedented move toward the application of computer-related technology in our jobs, our educational institutions, and our daily lives. On the job, computer-related technology is affecting almost everyone, from typists and machinists to business managers and social workers. The largest impact of the computer revolution has been the increase in the speed that information can be processed and transmitted to individuals. Access to information has always been a major educational and employment barrier to blind and visually impaired persons. Making computers accessible to blind and low vision persons is a complex, multifaceted task. Most commercially available hardware cannot be used without special access devices such as voice synthesizers, electronic braille displays, large print video outputs, and special software for managing these devices.

In order to help individuals learn the operation or application of special purpose devices and software, an exciting and innovative training program has been created. The Computer Training and Evaluation Center, (C-TEC) was established in October, 1983, under the auspices of the Federal Department of Education, Rehabilitation Services - Special Projects. C-TEC is a cooperative project of the Sensory Aids Foundation and the Veterans Administration-Western Blind Rehabilitation Center. The training facility is located at the Palo Alto, California, Veterans Administration Hospital. C-TEC provides both the Sensory Aids Foundation and the Veterans Administration with the capacity to evaluate recently developed aids and to participate in the development of emerging technology.

The Sensory Aids Foundation has successfully operated innovative employment programs for blind and visually impaired persons since 1975. Over 450 people have been directly assisted with job placement or consultation on work-place modification as a result of these programs. For the past five years, the Sensory Aids Foundation has been training rehabilitation professionals to use technology to solve employment problems for their blind and visually impaired clients. The Foundation has an international reputation for its knowledge of computer-related sensory aids and has served as a resource for agencies and educational institutions throughout the United States and several foreign agencies. The Sensory Aids Foundation publishes a quarterly journal and a subscription newsletter, Sensory Aids Foundation Update.

The Western Blind Rehabilitation Center mainly functions as a program for sight loss adjustment. The service concentrates on assisting visually impaired veterans with their adjustment to changing visual conditions. This service is provided via a four step rehabilitation approach: a complete low vision evaluation, training with prescribed aids, orientation and mobility, manual and living skills. Included in the living skills section is the Computerized Reading Aids program designed to provide instruction in the use of the VersaBraille and Kurzweil Reading Machine. The Veterans Administration research department provides information on new computer access equipment. This information is used by the Computer Reading Aids staff and C-TEC personnel to focus on the trainee's specific needs.

The principle objective of the C-TEC program is the provision of one-on-one or small group training for users of computer access devices. The training is focused on the operation and function of hardware and software for computer access. The training is not provided to teach students specific job skills, such as word processing or computer programming, however, it does provide the trainee opportunities to learn to use the devices and software and to interact with personal or mainframe computers. With this experience, the person may go on to the job training, or other programs to learn relevant skills.

Training programs are available to veterans, non-veterans, and professionals who work with people who are visually impaired. Applicants requirements are minimal:

1. The need for computer knowledge for education, employment, or personal use.
2. Adequate keyboard skills or a definable need for alternative input mechanisms.

Program Objectives

The primary annual objectives of the Computer Training and Evaluation Center are:

1. To impact the successful rehabilitation of 75 blind or visually impaired veterans and non-veterans through direct training on computer-related sensory aids.
2. To train 30 rehabilitation and/or special education professionals in basic computer literacy and the application of computer-related technology to the successful rehabilitation of their blind and visually impaired clients.
3. To serve as a demonstration center for employers,

blind consumers, rehabilitation and special education professionals, and the general public.

4. To evaluate computer related aids and to publish the results in professional journals and newsletters, and to disseminate results to state and federal agencies.
5. To develop new vocational and educational applications of computer-related sensory aids.
6. In collaboration with Sensory Aids Foundation's employment development staff, to assist 50 blind and visually impaired persons in exploring, obtaining, upgrading, or retaining employment in competitive, unsubsidized work settings.
7. To develop special needs software for application in employment settings.

Objective 1 - Direct Training

Direct, one-on-one training is provided at the C-TEC site. The original 75 student training projection for the first year of the program was based on an anticipated two trainees per week for an average length of training of three days. As the project developed, it became apparent that an average of five or six days was necessary to adequately prepare the student to use the devices chosen, and up to ten days may be required.

Typically, after the first day of evaluation and training, specific devices are selected that fit technical and user working requirements. Braille output, voice output, or a combination of both may be used by a totally blind person together with special software for managing the display of information normally seen on a video display (CRT). Individuals with severe visual limitations may be taught to use special hardware and/or software to enhance and enlarge the screen displayed print.

The hardware and software currently being used for training are: the Apple IIe computer with Echo II speech synthesizer, Braille-Edit and work station software; VersaBraille; the Cranmer Modified Perkins Brailler; and the IBM Personal Computer with the Promtwriter word processing system, Visualtek DP-11, and PC Lens, PC Speaks and Freedom I software programs.

During the first project year, 30 individuals received direct training, most were trained on equipment relevant to their existing employment situations. Twenty additional people have participated in group introductory computer classes. The goal for the second year is to provide direct training to 75 individuals.

Objective 2 - Professional Training

Three approaches have been adopted to achieve the objective of providing 30 rehabilitation professionals and educators basic computer literacy.

First, an introductory computer course (offered twice a quarter) addressed the goals of developing an understanding of computers, their accessibility for blind and visually impaired persons, and employment applications. This two-day program includes an introduction to computer terminology, equipment, educational and vocational applications, and access devices (braille, voice, and large print). The training is provided through didactic presentations, hands-on demonstrations, and the provision of lists of resources and guidelines to use when purchasing computer equipment. Fifteen professionals have completed this introductory course.

Although educators and rehabilitation counselors have participated in one-on-one training and small group sessions, a second approach has been developed to provide more extensive information on computer-related occupations, employment, equipment operation, and interface. A three-day workshop, to be presented in mid-October for 15 rehabilitation professionals, will provide an introduction to computers, computer jargon, hardware, input/output systems, custom software, employment opportunities, job assessment and accommodation, and hands-on equipment demonstrations. It is expected that this program, with some variations, will be provided by request to state rehabilitation agencies in the western United States several times in the coming year.

The third approach under development, is a teacher training course to be co-sponsored by C-TEC, the California State University at San Francisco, and the Lighthouse for the Blind in the Bay Area. It is expected that this course will be ready for presentation by the summer of 1985. This course will be a model that may be implemented in special education schools in other states. It is designed as a three-week program of daily classroom and laboratory instruction for teachers of blind and visually impaired youngsters, followed by a 10-day computer camp for teenagers. During the computer camp the teachers will be supervised while teaching the use of computer access devices.

Objective 3 - Demonstration Center

C-TEC serves as a demonstration center for employers and the general public. Regularly scheduled one-hour demonstrations of software, equipment, and training processes have been attended by more than 250 persons. Invited conference presentations and demonstrations have provided information to 150 employers during the first year of operation.

Objective 4 - Hardware and Software Evaluations

A systematic hardware evaluation process has resulted in reports on the Microbrailler, the Versa Braille and the Zorba Computer. Two devices are scheduled for evaluation of effectiveness with the IBM Personal Computer: the Professional VERT System and the Frank Audio-Data System. A software evaluation plan to be nationally disseminated, is being implemented with the creation of software evaluation protocol. This is an attempt to formulate a standardized evaluation procedure that will identify accessible software. Several programs for the management of voice output information for the IBM Personal Computer will be examined along with data base, word processing, and other general use programs.

Objective 5 - New Applications of Sensory Aids

C-TEC and sensory Aids Foundation professional staff are jointly developing new vocational and educational applications of computer-related sensory aids. Through meetings with members of the Smith-Kettlewell Rehabilitation Engineering Center and vendors such as Triformation Systems, Inc., Enable Software, Syntalker Systems, Inc., and Telesensory Systems, Inc., new approaches to solving problems are being explored.

Objective 6 - Employment Assistance

In collaboration with the sensory Aids Foundation's professional staff, C-TECH has provided, the first project year, direct placement assistance to 20 individuals interested in obtaining or upgrading employment. As this project developed, it became a technical resource to many blind and visually impaired users living throughout the United States and Canada. Written and telephone informational inquiries average 30 per week.

Objective 7 - Custom Software Development

Specialized software is being developed on an "as-needed" basis with the resources available from the C-TEC Advisory Committee, the Sensory Aids Foundation's professional staff, and technical consultation.

For example, a custom software program is being created to allow a blind emergency dispatcher access to geographic map coordinates. This program may have use in a broad range of applications. An automated radio station computer system will be accessed through a microcomputer equipped with voice output and special application software. The synthesized voice will provide the blinded operator with station operation cues, programming information, and wire service access.

Subordinate Objectives

Several subordinate objectives are also being addressed by the Computer Training and Evaluation Center.

1. A resource library of information on computer-related aids has been established. New resources and product reviews are continually added. The reference materials are used for training and for public information requests.
2. A "quick turn-around" braille and large print transcription service is being studied. Current manuals and reference materials are being prepared for trainees by converting them to hard or soft copy braille and/or synthesized voice audio cassettes. Printed information can be scanned by the Kurzweil Reading Machine or other optical character reading (OCR) device and transferred to machines that produce braille. With the support of volunteers, it is planned to make this quick transcription service available to the resident veteran population and special employment situations.
3. Tape duplication services will be made available to trainees and consumer population.

Conclusion

Evidenced by the statement on the cover page of the Fall, 1984, California Transcriber, there is an overwhelming need for information for professionals working with the visually impaired. "The influx of marvelous technological applications to the field of visual impairment leaves us breathless, bewildered and mind-boggled." This attitude is actively being challenged by C-TEC and several other special training programs for consumers and professionals around the United States. It is true that there is a strong need for coordinated resource gathering, product evaluation, information dissemination, and training of professionals and blind users in the day-to-day applications of computer technology in recreation, education, and employment settings, and for personal use. It is believed that through the efforts of the Computer Training and Evaluation Center and similar programs the positive benefits of the ever changing access technology can be managed and understood by both professionals and consumers, permitting competitive participation in the information revolution.

UTILIZATION OF TECHNOLOGY; CONSUMER PERSPECTIVE

MARGARET C. PFROMMER

ABSTRACT

Technology has impacted the lives of persons with disabilities in a positive way. However, only a small number of persons are benefiting from these technical products and services. The problem of technological underutilization has not been resolved, in my opinion, for three reasons.

First, when obstacles to the application, documentation, reimbursement, and manufacture/distribution are identified, they are treated as inviolable. Second, seldom, if ever, is a direct line of accountability set between those who have responsibility and the recipients, or supposed recipients, of the benefits of technical products and services. Third, appropriate consumers are excluded from attempts to resolve issues and solve problems.

The perspective I am bringing to my subject is that of an experienced and informed consumer. I am a typical consumer as I rely on technical products and services to maintain and increase my independence and productivity. In addition, I have for many years had the opportunity to work with professionals in the research, development, and application of technologies. Although this affiliation requires that I function with a high level of professionalism, it is understood that my primary accountability is to persons with disabilities. From this unique position I have been able to perpetuate the consumer perspective.

A need exists for an increased number of well-trained persons to work in all service delivery areas of the technical aids for persons with disabilities identity. Equally important is the need to upgrade the skills of professionals presently responsible for applying technology.

In order to meet the shortage of qualified professionals, two universities, Virginia and Drexel, are currently providing training for clinical engineers. The University of Virginia is accepting both engineers and therapists in its program. The engineer develops clinical skills, and the therapist learns engineering concepts. Only time will tell if this training is adequate and if graduates will get into actual, competent application of technical aids in sufficient numbers.

My own experiences with inadequate professional application of technology led me, several years ago, to conclusions now supported by the 1982 Office of Technology Assessment

Report which states "Those providers who are permitted by the structure of delivery and reimbursement systems to prescribe technologies for disabled people may not always be the most appropriate ones to do so." The above quotation shows that not only consumers question professional competencies, but that professional peers also are concerned. Those inappropriate providers are usually the parties whose values and goals determine the appropriate application of technology.

I have had the good fortune to work with professionals who are skillful in their application of technology. I also have had the misfortune of being the client of other professionals whose incompetence contributed to many years of unnecessary discomfort, dependence, and isolation.

Biases on the part of professionals often interfere with good service delivery.

As a consumer, I object to the whole idea of rigidly defined goals for evaluating the appropriateness of a technology. Many persons who define goals actually set limitations under the guise of "being realistic." For example, some professionals have refused to prescribe a pneumatic wheelchair control (puff-and-sip) for persons on ventilators because the professionals lack the knowledge that such persons can make good use of this control device.

It is not possible to explicitly state goals. What is possible, and often happens, is that a prescribed technology opens opportunities undreamed of by any of the prescribers; a desire and need for additional technology is created. In my work applying technology, I have often been amazed with the positive synergistic effect of good application and use of aids. Professionals who straightjacket themselves by explicitly defining goals deprive themselves, their clients, and the world of the ultimate benefits of technology. I am convinced that the misuse and misapplication of technology causes and perpetuates disabilities.

As an informed consumer, I understand and sympathize with some of the problems of good service delivery. Common complaints from people delivering engineering services are: (1) they have to put much time and effort into the search for information about the proper application of technical aids and their benefits, and (2) in many cases, in order to receive payment for their services, they must search for reimbursement. The investment of time and energy in these two areas reduces the time and effort that can be expended in their rightful area of expertise.

The proper application of technical aids is a very time consuming task. Collection, documentation and better information sharing could reduce the hours and efforts.

Unfortunate information gaps exist. I am occasionally contacted by rehabilitation practitioners, vocational counselors, and others, requesting a source of information for technical aids in general. It is apparent that these people do not have the time or knowledge to contact many different sources and want to plug into one source; they would like to press a button and have the answer fall into their laps. I question the concept that a central data bank is the total solution. The information in such a bank would probably be limited and the data bank concept presently leaves out the knowledgeable advocate, person who is not a manufacturer/distributor who can explain subtle differences in devices and properly apply a particular device to a specific need.

My answer to callers for general information is there is presently no one source where a person can obtain all information about all technical aids. It seems to me that, at this time, a better procedure is to seek clinical engineering services to meet individual client needs. In the process, the practitioner will gain experience and awareness of other sources of information.

Probably the most valuable resource for professionals applying technology is attendance at workshops and conferences where conference proceedings may be obtained and where valuable contacts with other professionals in the field may result in future interaction.

Professionals in the research and development area also lack a data bank from which to draw over-all and unified information. Most of the information is scattered, know only through the personal experience of researchers. Although the journals are useful, the most valuable way to gain information seems to be through personal contacts.

As to those who apply technology, researchers and developers must spend disproportionate amounts of their time in searching for current information in order to do the best job possible and to avoid duplication of effort.

There still are other groups who need good information in order to better use technology: policy makers, manufacturers, marketers, and distributors of technological products. Four specific resources that would be helpful to all these groups are (1) the greater use of clinical engineers, (2) technical assistance for the disabled projects, (3) a consumers report on technical aids, (4) and equipment demonstration units.

Although individuals in the rehabilitation professions have recognized the usefulness of clinical engineering for persons with disabilities, the discipline has seemingly not been accepted as an integral part of the rehabilitation process. Few facilities have clinical engineers on their staffs and only a small number of vocational counselors use the services of engineering clinics for their severely disabled clients.

Greater use of clinical engineers would insure that better selections of appropriate devices for individual disabilities are made.

(1) The clinical engineer works with disabled persons to become aware of their individual needs and then applies unique technical aids to meet those needs.

(2) The engineer guides disabled persons through the maze of available aids by experience and information.

(3) The engineer makes suggestions for modifications (e.g., method of control) that may determine whether a disabled person uses or does not use precribed devices to their fullest potential.

Other than a few talented rehabilitation professionals, there are no professionals that can provide this service other than clinical engineers.

Another service that would be beneficial is the establishment of technical assistance for disabled projects. Projects would allow disabled persons to obtain maximum benefit from their technical aids. One aspect of such a project could be the organization of volunteers for use in hands-on activities and the modification of home areas and/or job sites. Modifications could include building or altering work tables, installing simple electronic equipment such as environmental systems, changing doorknobs., providing interior and exterior ramps. The proposed service component could also collect information about technical aids and materials for use in modification. In some cases, ideas and designs might be provided for the user. Further help could be provided by estimating costs, by suggesting sources for funding, and by supplying standard specifications for modifications to doorways, ramps, and other environmental blocks.

The greatest value to all concerned probably lies in the data obtained from follow-up procedures. Data may be used:

(1) to see if a particular modification works well and could be applied to another persons needs.
(2) to gain new ideas.
(3) to supply information to manufacturers of technical aids that may be helpful in design modifications.
(4) To provide information to third-party payers so that they can include the cost of environmental modifications with the technical aid.
(5) to provide a realistic picture of the current cost of environmental modifications.

A consumer report on technical aids would be of great value to third-party payers, prescribers, and users. This would report evaluations independent of the manufacturers. The evaluation of equipment could have three aspects:

(1) testing of engineering performance (the technical specifications).
(2) studying a device's applicability, reliability, serviceability, and maintenance system.
(3) examining the subjective responses of the user and of professionals involved with its application.

Technical equipment demonstration units would be of particular interest to prescribers and third-party payers. These units could provide additional assurance that the most appropriate technical aid is selected and the best possible use made of available funds. What should be of equal importance to agency professionals is that a wise choice of technical aids including a careful expenditure of money, has the ultimate result of providing a better quality of life for their clients with disabilities. A technical equipment demonstration unit ought to meet certain requirements:

(1) It should offer technical assistance from knowledgeable persons who can direct a potential user to appropriate technical aids and guide him through a process of hands-on use.
(2) It should provide oral and written information on technical aids including their similarities and differences, to assist in a final selection.
(3) It should display a wide variety of technical aids available for hands-on use set in simulated typical environments.
(4) It should be cooperatively planned by all rehabilitation facilities in the area so that all would feel comfortable using the service as part of their rehabilitation programs.
(5) Because of the large investment in set-up and maintenance, it should be located in a densely populated area and serve as many people as possible.

The opportunity for consumers to try a technical aid before they, or their funding agency, makes an investment is especially important in view of the present practice of requiring full payment before a device is ordered.

Even when well-qualified,

well-informed professionals have prescribed technology for informed consumers who have made good choices among the available aids, too often there remain financial barriers to the acquistion of these aids.

The systems of reimbursement that do not pay for the more expensive technologies do not provide options for consumers to use their own resources to make partial payment. Professionals continue to allow themselves to be compromised by the payment system; rather than prescribe the appropriate device, they settle for one that is affordable. The outcome is a consumer that receives only partial benefits or one that is further handicapped. Reimbursement systems should be expanded to provide more sophisticated technologies that clearly can, be justified on the basis of cost effectiveness and/or improved quality of life. Most modern technology is really non-medical and should not require the added expense of a physician's prescription.

There is a reluctance on the part of some (distributors, for example) to change the status of technologies clearly not medically oriented (e.g. wheelchair batteries) to "non-medical" because of the reimbursement system. For the consumers, this perpetuates their image as sick people who depend on the medical system for their very existence.

Much technology for persons with disabilities has been generated by government-funded research and development programs. These programs have been criticized for putting a low priority on production, marketing, and diffusion activities. It would be more accurate to say that, because of their limited resources, research and development organizations have been forced to place a low priority on those activities. Because research and development organizations are not mandated to engage in the production, marketing, and diffusion of technologies, any efforts in this area are not recognized when grants are being awarded. Actually, the typical organization, having put forth great effort in developing a product or service, is eager to see it provide benefits to as many people as possible. It is the manufacturer who could be criticized for not putting forth efforts to conduct activities such as demographic studies which could lead to the development of good marketing strategies for the wide-spread use of technical products and services.

There is a need for better relationships between manufacturers and customers. Many companies are too distant from the people who use their products, thus, they fail to operate with a fine sensitivity to concerns of their customers.

The manufacturer/distributor should assume responsibility for a reliable product that can be adequately maintained. If the product is good and meets a need, the user will become inevitably dependent upon it. Even the most reliable equipment breaks down; a valuable service could be provided by loaning or renting a spare. This could prevent a complete change of life style and avoid a shift in dependency back to human beings.

One observation I have made through the years has to do with the pricing of certain technical aids. Some companies bear the cost of their own research and development. Others benefit from research and development programs funded by the government. Yet, those companies that benefit from government research sell devices very similar to those offered by others at approximately the same cost, with no savings passed on to the consumer.

I have heard the government repeatedly condemned for insensitivity to issues regarding persons with disabilities and in many areas the criticism is valid. However, in the area of research, development, and use of technology, government funded programs, even with limited resources, have played a leadership role.

As the private sector continues to lag behind, I look to the government to stimulate that sector's interest and to make its own participation more meaningful. For example, congress might legislatively charter a private organization to provide marketing and production-related services, or to conduct evaluation projects that are clearly and cleanly separated from the functions of assisting the marketing of products. I very strongly urge that a component of any evaluation process include a consumers report.

The government has another great need to coordinate the activities of its separate agencies and departments to bring good products and services to persons with disabilities. This opinion is not mine alone, but is an opinion I have heard expressed by consumers and professionals alike.

I would like to see a greater number of qualified consumers working to solve this problem and other problems on a national level. Consumers working at the national level need to be truly representative of the population they serve. Qualified consumers are persons who (1) have a disability, (2) possess social maturity, (3) use technical products and services, (4) participate in consumer organizations or demonstrate good contact with the community of persons with disabilities, (5) represent the point of view of a sizeable number of persons with varying disabilities (being aware of a variety of lifestyles and experiences), and (6) possess a working knowledge of the area in which they are participating.

There is a consensus of all persons involved with technology and handicapped people that independence and employability are not only important human aims, but also sound economic goals. It is generally recognized that the good use of technical products and services will permit persons with disabilities to earn their own living and/or reduce assistance.

No matter how well people are equipped with technical devices and with personal and intellectual capabilities, the disincentives of our society prevent them from reaching their full potential for independence and employability. Disincentives include inaccessibility to buildings, programs, and facilities, archaic social security and tax structures, and attitudes which impede role changes.

Encountering and resolving the many problems connected with underutilization of technical products and services can be overwhelming if we permit them to be, but, along with you, I am ready to commit myself to the task.

PROJECT INTERACT:
MICROCOMPUTER SOFTWARE FOR VOCATIONAL REHABILITATION FACILITIES

ROBERT C. ROBBINS
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ABSTRACT

Through a detailed system analysis, Project INTERACT has merged rehabilitation and production requirements to develop an interactive database system. Under a grant from the Rehabilitation Services Administration, the project is developing and testing a comprehensive client activity, progress tracking, and a piece rate/incentive payroll system. This paper discusses the process used in developing the computer system and the factors considered in making the software readily portable between facilities and microcomputer systems.

In September of 1984, Metro Industries, Inc., received a three year grant from the rehabilitation services Administration to develop software for vocational rehabilitation facilities. Because vocational rehabilitation facilities generally operate with tight budgets, the grant proposed that this software be developed to run on inexpensive microcomputers and be user friendly to allow a non-data processing professional to operate the system (Norris, 1983b). In addition, the software was to be developed specifically for use by direct service providers.

These provisions were in response to the needs of a typical facility in respect to budgeting and staff time. As demands for employee outcomes (job placements, etc.) are increased, training time requirements increase; but this is not all. As public funds become scarce, accountability demands for funding agencies are increased (Simon, 1982), and, in turn, documentation requirements in the form of paperwork are increased, thus the dilemma is created of staff doing paperwork instead of training, or training and not having time to do paperwork. There is also the issue of obtaining timely training information for feedback to employees. Often analyzed productivity and other training information is not available for as long as a month, thus limiting the quality of feedback to the trainee.

Project INTERACT addressed these needs by setting the following goals:

1. Develop a software system that primarily is direct service based.
2. Reduce paperwork requirements for direct service staff as well as for bookkeeping staff.
3. Provide real time (instantaneous) information in the areas of production and training to aid in increasing employee performance.
4. Provide timely information to facility management.
5. Develop a system which is both portable and versatile.

Developing the Interact System

Software:

To insure a comprehensive system design, several key resources were used. A weekend retreat for facility staff was held to discuss the Projects's goals and solicit suggestions for the proposed system. Each staff member was asked to list the functions that he/she would like to have computerized. Direct service staff suggestions were given prominence, an approach that is seldom taken in the development of a computer system. Usually, the managerial staff decides the system's functions. However, one of the Project goals was to increase employee (client) performance. To do this, direct service providers must have productivity and training information on real time basis and in a per employee format (Bellamy, Horner, and Inman, 1979). To gain professional resource perspectives, two advisory committees data processing, rehabilitation and education professionals from across the state of Kentucky, as well as from Ohio, Tennessee, and Missouri were formed. These committees were to review Project results and make suggestions for system development. In addition, a systems analysis/design consultant was hired; this provided a resource on a day-by-day basis to answer specific questions and oversee the development process.

Another valuable resource used all during the Project development was microcomputer trade journals. The journals studied by Project staff and pertinent information was used to insure state-of-the-art system design. This process is still in use with the Project staff.

A detailed facility survey of the southeastern United States (Indiana and Ohio) was then developed and implemented. The survey was conducted on the premise that the needs of vocational rehabilitation facilities needed to be identified before a solution could be developed. The survey addressed the use of and the need for computers within facilities. Briefly stated, the results indicated that most facilities did not have in-house computers. Of these, forty-four percent were planning to buy a microcomputer system within the year. Eighty percent of all responding facilities were interested in the proposed INTERACT system. After these initial steps, the Project staff began a formal analysis of Metro Industries'system.

The system analysis was performed for all areas of the facility, rehabilitation, production, and financial. All forms used by the facility were collected and cataloged, indicating the key data elements (pieces of information) on each form. Each staff member was interviewed to determine the information he/she needed to perform his/her job. Each form that the staff member used, was identified by information origination, the person who completed the form, and the receiving party of the completed form (e.g., a person, a file, etc.). In addition, each staff member was again asked what they would like the proposed system to do. This information was combined with the forms catalog, to give a clear indication of the information flow within the facility system. From these catalogs, flowcharts were developed to depict the facility information system. A listing of all data elements collected within the facility was also compiled. A quick look at this list indicated if a data element was cataloged, or if it needed to be added. This analysis process took about two months to complete.

Next was the system design. The considerations were eliminating duplicate data entry, and tailoring the system for computer/input. New forms were developed that were in the format of a computer screen; they could however, just as easily be printed for longhand entry. In addition, report forms were also developed. These forms met the information requirements of both the direct service and management staff. At that time the processes (analysis of information) were not detailed. Because most of cost of the copying, compiling and analysis would be performed with a computer, detailing the final processes would occur at a later time. In developing a system extreme caution should be taken lest some obscure piece of data be forgotten. To double and triple check the newly designed system, it was compared in detail to the forms catalogs and flowchart. Then each staff member reviewed the new system, making sure that his/her information needs were included.

At this point, a new system for Metro Industries had been designed. One of the Project goals was to have a system that could be used by other shops as well; therefore, the new system had to be compared to systems in other facilities. Three facilities similar to Metro Industries reviewed the system and suggested changes were implemented. Next, each member of the advisory committees was asked to review the system design with respect to his/her area of expertise. During this review, directors and managers of eleven (11) facilities and (2) specialists from the state Office for Vocational Rehabilitation compared this system with their own and with systems that they had seen in other facilities. Again changes were recommended and implemented.

In summary, the system analysis and design steps were very important in developing the computerized system. The suggestions of each staff member were considered. All facility forms were collected and cataloged, indicating the flow of information within the system. This flow was then depicted with flowcharts. A new system was designed and compared to the old system to ensure that all necessary data elements were included. The system then was compared to that of other facilities and reviewed by the project advisory committees. Because of this thorough process, it is felt that the INTERACT system is complete and capable of easy adaptation to other vocational rehabilitation facilities.

Hardware and Development Software

The research on hardware and development software was an ongoing process of telephone and mail inquiries about products reviewed and advertised in industry trade journals. After a lengthy period of research, the Project staff determined that a fifth generation applications development database and a networking system for microcomputers would best meet the Project's goals. It was felt that the ability of the INTERACT software to run on a single microcomputer, as well as a series of networked computers, was essential in meeting the functional and financial needs of a typical facility. Furthermore, it was felt that developing the software in a language that could be maintained by a non-data processing professional also was essential in meeting the Project's goals. The system that the Project staff selected allows the software to be run on a single microcomputer or on as many as twenty-four (24) microcomputers networked together for information transfer. The hardware system selected is IBM-PCs or compatibles networked with Novell network that allows most MS-DOS (IBM compatibles) machines to operate together. At present, the Project has six IBM-PCs, three AT & T 6300s, and a COMPAQ portable networked together with the Novell.

Currently, the system design is being prepared for programming by a software development firm in St. Louis, Missouri. As is evident, the INTERACT system was developed with consideration for the financial and information needs of vocational rehabilitation facilities.

The INTERACT System

In general terms, the INTERACT system integrates the areas of Rehabilitation, Production, Payroll, and Management Information. Because the software is direct service based, it is tailored to meet the needs of floor supervisors and counselors. However, detailed management information and payroll information is generated by analysis of the information collected by the direct service staff. The following is a partial list of features that the proposed INTERACT system offers:

Rehabilitation/Training:
- Employee Information Master file
- Employee Demographic Information
- Immediate availability of Employee Medical information
- Interactive data entry of daily information by floor supervisor
- Training plans developed, monitored, and updated on-line
- Productivity and quality information available for immediate feedback to employees
- Automated attendance monitoring and reporting
- Monthly Progress Reports on training, attendance, productivity, quality, with comments permitted per employee
- On-line activity tracking per employee, i.e., counseling, classes, ancillary services, etc.
- Automated date-cueing for training, attendance, productivity, quality, per employee
- Employee information sorted by many different variables
- Skill Inventory per employee indicating activities/jobs employee has performed along with productivity, quality, difficulty level, and date last performed
- Automated generation of employee attendance notices

Production:
- A comprehensive piece rate/incentive payroll system which meets Department of Labor requirements
- Production Scheduling
- On-line inventory maintenance and reports
- Easy entry of job/activity number per job/activity
- On-line job specifications
- On-line productivity and quality reports by individual, department, and facility
- Job/activity Master File indicating an activity number for jobs, counseling, ancillary services, classes, etc.

- Company Master File indicating company information per company limitations?
- Automated work orders
- Automated job status reports
- Automated shipping ticket generation
- Job Costing per contract/job

These are some of the more important features of the system. Information on features will be available from the INTERACT staff.

Advantages of Using the INTERACT System

The INTERACT system is an integrated, user-friendly information system designed specifically to meet the needs of the workshop environment. It was designed by professional rehabilitation/production workshop personnel whose objective was to make the computer system bend to meet workshop needs. Because of the comprehensive review and design, many features will substantially decrease the vast amount of paperwork currently taking place in a majority of the facilities. The development language being used for programming provides an excellent security feature for protecting sensitive or confidential information from unauthorized personnel. Used by a network, the software will provide up-to-the-minute information previously not available to the average facility. The major advantage, however, is that the entire system is being designed using federal funds, and will be available at a fraction of the cost of existing workshop systems.

Cost of the INTERACT System

Software:

The software for the INTERACT system will be available to facilities on a net cost basis. Included with the software will be operator and user manuals, providing the complete documentation necessary for running the software. Cost estimates to date, including the run-time module of the development language at $300, plus the cost of documentation and duplication, will probably be between $500 and $1,000.

Hardware:

The cost of the hardware will be contingent on the number and type of computers a facility selects, plus the cost of the Novell network. An estimate for a four user system using IBM-PCs, a twenty megabyte hard disk, and a linear bus network from Novell, would be approximately $20,000. A seven user system using IBM-PCs, a sixty megabyte hard disk, the Novell network processor (a star network configuration) and a forty-five megabyte tape back-up system would be approximately $35,000.

The system will also be able to run on a single microcomputer with a hard disk attached, e.g., the IBM AT machine. Additionally, the Novell network is not the only network that will be compatible with the system. Several other networks, e.g., Omninet, 3COM Ethernet, PC Net, and Davong Multilink, will run the system as well. The costs for these networks vary. Your local computer retailer can give you the prices on request.

As you can see, the system is very flexible in cost and equipment. Almost any facility will be able to find an affordable, cost effective hardware configuration that will meet the facilities needs.

Availability of the INTERACT System

The INTERACT software tentatively will be available to facilities by October 1, 1985. However, test facilities will begin implementing the applications for software by May, 1985. Applications for software test sites are being taken currently. Test facilities will be chosen by type of facility, location, and willingness to allocate resources necessary for implementation. If your facility is interested in being a test site, contact the Project staff.

Summary

The INTERACT system is an user-friendly, integrated software package for vocational rehabilitation facilities. This system includes comprehensive applications in the areas of Rehabilitation/Training, Production, and Employee Payroll. Management information can be compiled from these information areas, and formatted into various types of reports. The system will cost between $500 and $1,000, including documentation. Availability tentatively is scheduled for October, 1985.

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